PROCEEDINGS

OF THE

ROYAL SOCIETY OF MEDICINE

EDITED BY

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UNDER THE DIRECTION OF

THE EDITORIAL COMMITTEE

VOLUME THE TWENTY-SIXTH

SESSION 1932-33

PART II

MAY TO OCTOBER

LONDON

LONGMANS, GREEN & CO., LTD., PATERNOSTER ROW

1933

Section of Pathology.

President—A. FLEMING, F.R.C.S.

[*March* 21, 1933.]

The Differential Diagnosis of Tuberculo-Silicosis.

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IT is generally accepted that the inhalation of cystalline silica produces a nodular fibrosis in the lung which is characteristic of silicosis and silicosis alone. It is also generally agreed that this fibrosis is not caused by the mere physical properties of the inhaled particles, but follows their solution in the body fluids. This does not mean that all the inhaled silica goes into solution; a considerable quantity remains unaltered and can be recognized in the form of doubly refracting particles when sections of the lung are examined by polarized light—though it must be realized that there is no proof that all such crystals are actually particles of silica.

Unfortunately, however, a nodular fibrosis is not the only pulmonary lesion which can be produced by the compounds of silica. Asbestos, as is well known, causes a diffuse fibrosis which is quite different from the classical picture; and it may be that other silicates are capable of giving rise to anomalous reactions. Moreover, although a pure silicotic pneumoconiosis undoubtedly occurs, it seems to be a rather rare condition. In this country silicosis is very frequently associated with tuberculosis, and the same thing seems to be the rule in other parts of the world. A. Sutherland Strachan and F. W. Simson (1930) writing of silicosis on the Rand say, "If a silicotic patient does not die of some other disease or by accident he will ultimately die of tuberculosis"; and in a recent publication A. Policard (1933) suggests that while pure silicosis is a theoretical possibility, it is rarely a practical reality—"En fait, dans l'immense majorité des cas, sinon dans tous, le poumon silicotique est toujours aussi un poumon tuberculeux."

Frequently, the tuberculous element in the process is quite obvious, either from the histology of the lesions or from the presence of large numbers of tubercle bacilli. But in many cases the diagnosis is not so clear, and the lesions assume the characters of what is called by South African workers "infective silicosis." By this term is meant the modification which chronic or localized acute infections undergo in the silicotic lung, resulting in the production of lesions characterized by an excessive fibroid reaction. In the silicotic lung an excessive fibrosis may be the end-result of any inflammatory process, but the infection is usually a low-grade tuberculosis (Simpson, Strachan and Irvine, 1931).

Hitherto attention has been chiefly directed to the demonstration of the infective element in the process, the presence of silica being taken for granted. Usually, no doubt, this assumption is quite justifiable, but from time to time cases occur in

which the tissue reaction is so anomalous that doubts may well arise about the influence of the dust factor in the disease. Fibrosis of the lung is not necessarily diagnostic of silicosis; only when the fibrous tissue is laid down in the characteristic whorled nodules can we assert with confidence that it is indicative of the presence of silica. In the absence of these lesions the recognition of a silicotic lung must rest upon some other criterion.

An examination of sections by polarized light will usually give an indication of the dust content of a lung, but as Belt (1929) has shown, there is no regular parallel between the number of visible crystals and the actual amount of silica in the lung ash; part of the silica becomes converted into an "occult" form, and can only be revealed by chemical analysis.

For some time we have been combining a histological examination of lung tissue with a chemical analysis in order to determine whether any correlation could be demonstrated between the silica content and the structural changes present.

The technique we have adopted is as follows:—

Portions of the lung are selected covering the site of any specimens taken for histological examination. As far as possible large amounts of 150 to 200 grm. are taken, in order to give an average result for the selected area.

The whole of the specimens are coarsely minced and dried at 100° C. until they become friable. The dry tissue is then finely powdered by grinding in a coffee mill. After thorough mixing the powder is dried to a constant weight at 110° C.

About 10 grm. of the powder is taken for analysis and ashed in a platinum crucible. The ash is weighed and its silica content assayed by the usual gravimetric method, viz., fusion with alkali carbonates, precipitation of the silica by repeated treatment with hydrochloric acid, ashing the precipitate and determining the true silica content of this ash by treatment with hydrofluoric acid.

In a few instances it was desirable to know the silica content of small portions of tissue in which the total quantity of silica present was much too small for gravimetric assay. In these cases a modification of the colorimetric method described by King (1928) was used. The silicon content of the dried lung is expressed in terms of SiO_2; no attempt has been made to differentiate between free and combined silica. So far we have made no systematic attempts to ascertain the amounts and proportions of bases associated with the silica, but the great variation in the quantity and appearance of the ash obtained from these and many other specimens suggests that a quantitative analysis of these bases might possibly throw light on the type of siliceous material involved in the production of fibrosis, or might show that the predominance of certain bases has an influence on the stages of conversion of insoluble silica into the soluble state in which it must at some time pass, in order to exert its toxic or irritant effects.

The result of those combined investigations has strengthened our original impression that in certain cases the differential diagnosis of infective silicosis may be a matter of considerable difficulty.

A good example of infective silicosis is illustrated in Case P. 16 of our series.

The patient, a man aged 64, had been working for twelve years in a flint-crushing plant. The lung (fig. 1) shows, in addition to greyish-yellow foci of obvious tuberculous consolidation, diffuse areas of dense black fibrosis: and scattered through it are small, hard, blackish nodules. Microscopically (fig. 2), the diffuse black portions show an intimate mingling of structureless caseous material with dense bundles and strands of acellular fibrous tissue; an occasional tubercle bacillus can be demonstrated, but there is no typical tuberculous histology. The isolated nodules often show the characteristic laminated, whorled structure of the silicotic lesion (fig. 3), but in many of them there is a certain amount of central caseation (fig. 4), and it is possible to trace all the stages between small active foci containing tubercle bacilli, but with an unusual amount of peripheral fibrosis, and the mature fibrous nodule. With polarized light a fair number of doubly refracting particles can be seen, and a chemical analysis gives a silica content of 2·7% of dried lung.

In this case, therefore, there was a tuberculous infection in a lung which contained a considerable quantity of silica (in our experience an ordinary dried lung does not contain more than about 0·2% of silica). The infection appears to be of a low-grade type, and the excessive fibrosis which distinguishes the tissue reaction would seem to justify the diagnosis of infective silicosis, for there can be no doubt of

FIG. 1.—Drawing of portion of the lung from Case P. 16, showing massive pigmented areas of infective silicosis with foci of caseous tuberculosis. Small areas of nodular fibrosis are scattered throughout the lung.

the pneumoconiotic element. A naked-eye examination of the lung alone, in the light of the patient's industrial history, is sufficient to allow of a diagnosis being made. But a low-grade tuberculosis in which fibrosis is a conspicuous feature of the tissue reaction is common enough in this country, and the question arises whether it is possible to differentiate on anatomical and histological grounds between it and those

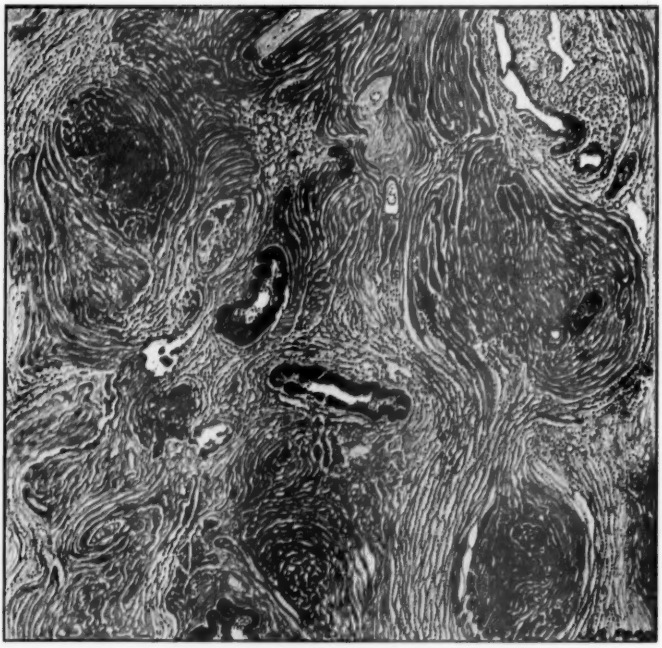

FIG. 2.—P. 16. Low-power drawing of a massive fibrotic area showing combined fibrosis and caseation.

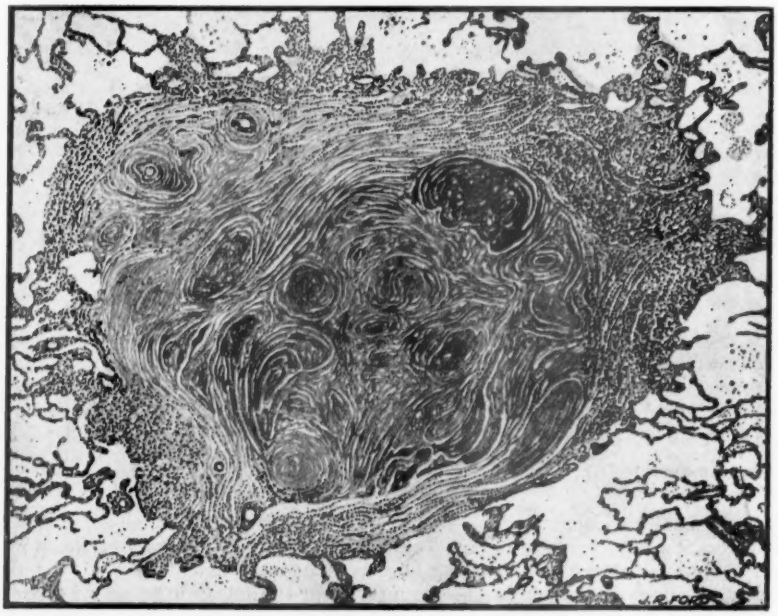

FIG. 3.—P. 16. Low-power drawing of an isolated nodule showing the characteristic laminated whorled fibrosis.

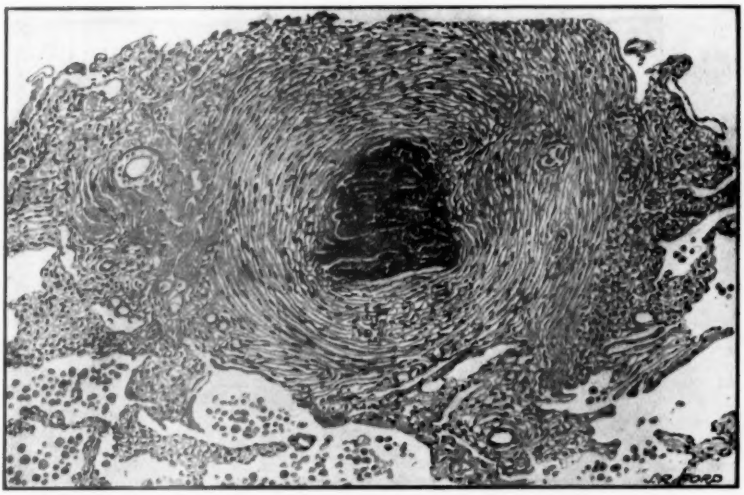

FIG. 4.—P. 16. Low-power drawing of an early nodule showing central caseation and surrounding fibrosis.

cases in which the infection is modified by the presence of silica. It is, of course, a matter of major importance, for a chronic fibroid tuberculosis may occur in a worker employed in a dusty industry as well as in any other member of the population, and in such cases it is necessary to determine what influence, if any, the individual's occupation had on his disability or death; whether, in fact, he is entitled to compensation.

A form of chronic fibroid tuberculosis is illustrated in the next case, P. 33. The patient, a man aged 41, died from a carcinoma of the left bronchus which widely involved the left lung. He had never worked in any dusty trade. Scattered throughout the right lung were several considerable areas of dense black fibrosis and there was much scarring at the

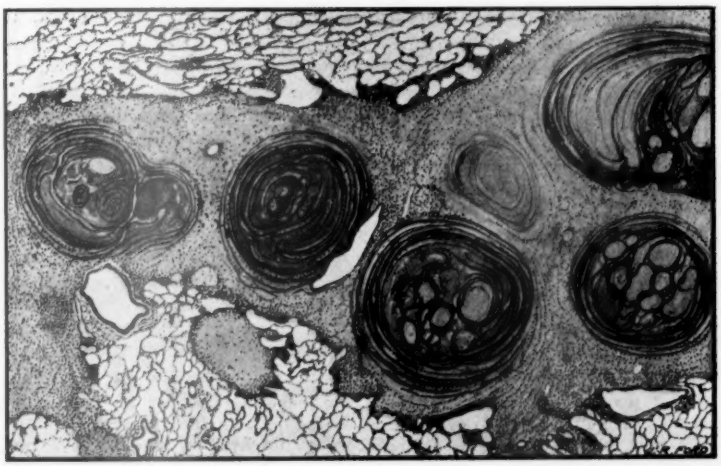

FIG. 5.—Low-power drawing of a portion of the lung from Case P. 33, showing massive fibrosis with whorled fibro-caseous foci.

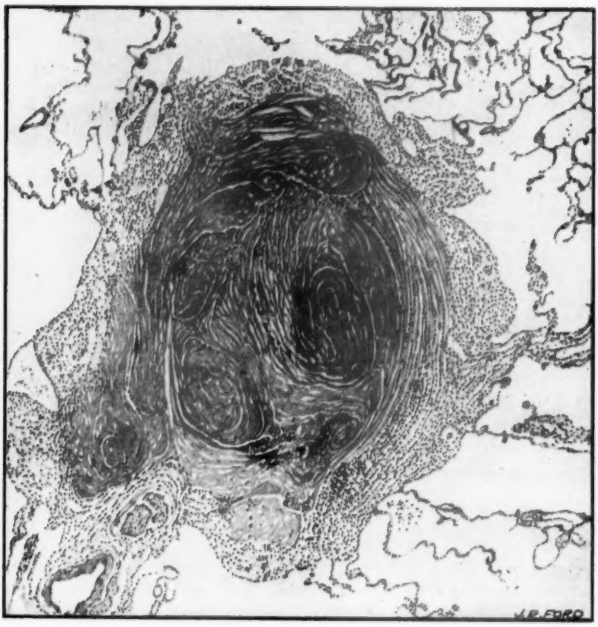

FIG. 6.—P. 33. Low-power drawing of an isolated fibrous nodule. Cf. fig. 3.

apex. Microscopically these areas show a condition of caseation and dense fibrosis which is indistinguishable from the massive lesions in the previous case. Moreover, in the larger masses (fig. 5) and in small outlying foci (fig. 6) the fibrous tissue has the whorled arrangement believed to be characteristic of silicosis.

No tubercle bacilli were actually demonstrated in the pulmonary lesions or in the massive gland at the root of the lung, but here and there the histological reaction makes the nature of the infection pretty clear. On the other hand, there is no evidence of pneumoconiosis, for the man was never exposed to unduly dusty atmospheres and two separate analyses showed a silica content of only 0·21% and 0·1% of the dried lung. The involvement of the lung is much more extensive in P. 16 than in P. 33, and the fibroid lesions more massive, and this alone suggests the presence of some other factor than simple tuberculosis. But we submit that a pathologist confronted with microscopic preparations of the two cases would find the greatest difficulty in arriving at a differential diagnosis. The crux of the matter is the meaning of the term "excesssive fibrosis," and the significance we should attach to the occurrence of laminated, whorled fibrous nodules. How much fibrosis is compatible with the healing of a simple, uncomplicated tuberculous infection? And can the healed fibrosed tuberculous nodules assume the laminated whorled appearance believed to be characteristic of silicosis?

Three other cases occurring in our series present interesting features for comparison.

P. 20, a man aged 56, had worked as an edge-tool grinder on wet sandstone for thirty years. The lungs show a generalized coarse nodular and trabecular fibrosis (fig. 7), and there were large hard glands at the roots. The case was sent to us as one of pure silicosis, but the distribution of the pulmonary lesions, and certain features in their histology

and in that of the root-glands suggest that an infective factor had taken some part in the process. But histologically there can be no doubt about the silicosis. Fig. 8 shows the laminated structure of one of the fibrous nodules, and chemical analyses of different parts of the dried lung give a silica content varying from 0·24 to 0·69%.

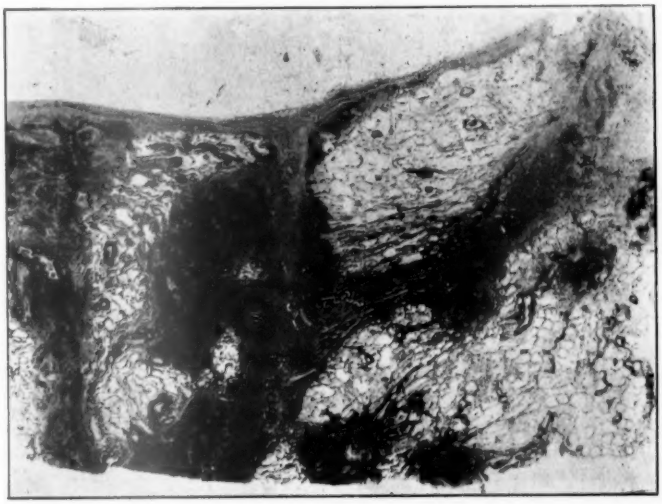

FIG. 7.—P. 20. Low-power photograph of a section of the lung showing trabecular and nodular fibrosis.

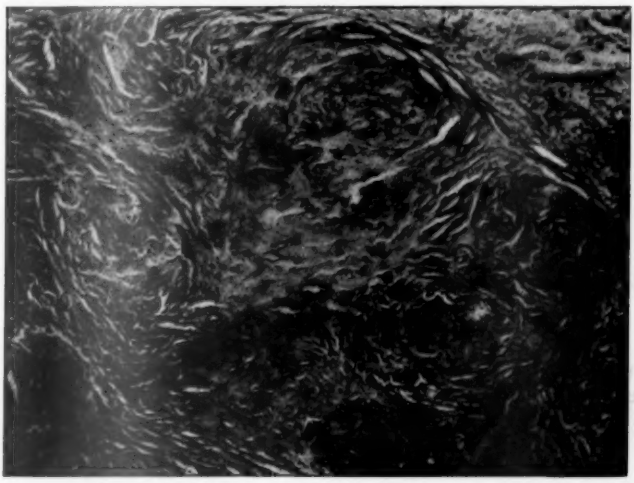

FIG. 8.—P. 20. High-power photograph showing the structure of a fibrotic area.

P. 68, a market porter aged 39, died from myocardial degeneration. His lungs showed much dense scarring at both apices with a small cavity in the left one. Scattered throughout both lungs were many small chronic fibro-caseous nodules. The actual amount of fibrosis

FIG. 9.—P. 68. Low-power photograph of a section of the lung showing fibroid tuberculosis.

is very little short of that present in Case P. 20, though the fibrous tissue is more diffuse than nodular in its distribution (fig. 9). The tuberculous element in the process is quite obvious, but there is an unusual degree of fibrosis around the caseous foci (fig. 10) and the oldest lesions bear a close resemblance to silicotic nodules (figs. 11 and 12).

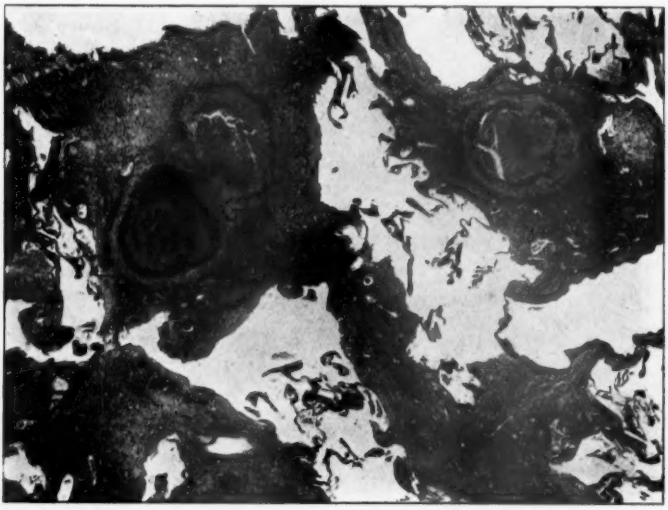

FIG. 10.—P. 68. Photomicrograph of section of the lung showing two caseous foci surrounded by fibrous tissue and a heavily pigmented nodule in which fibrosis is complete.

A complete industrial history is lacking in this case, but there is no reason to suppose that the man was ever employed in a dusty industry, and a chemical analysis of the lung shows no more than 0·16% of silica in selected areas, and 0·06% in the lung as a whole. There is, therefore, no reason to regard this man as

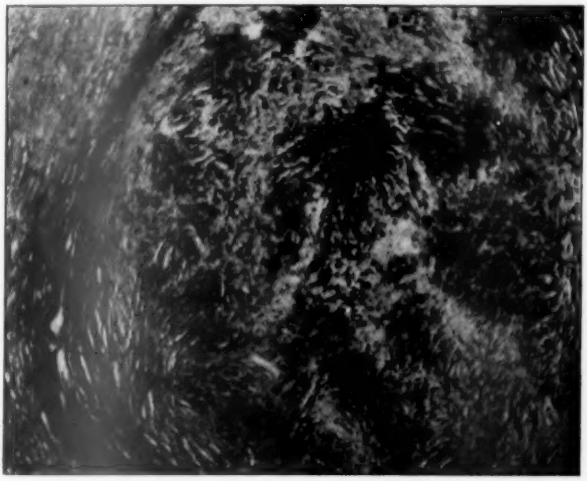

FIG. 11.—P. 68. Portion of the pigmented nodule shown in fig. 10. Cf. fig. 8.

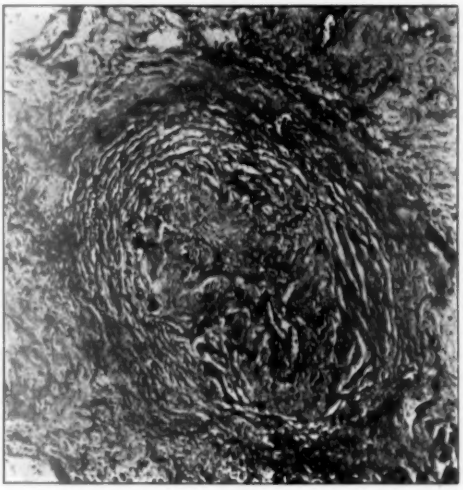

FIG. 12.—P. 68. Nodule of healed tuberculosis which closely simulates a silicotic nodule.

a silicotic, but had he been employed in a trade with a recognized hazard it would have been difficult to deny, from a histological examination, the possibility of silicosis.

A very similar type of nodular fibro-caseous tuberculosis was seen in another case, P. 46. This man, a sanitary earthenware placer, had actually been in receipt of compensation during

life, though the claim was disallowed a year or so before his death. His lungs presented extensive caseous tuberculosis and, in addition, many scattered fibro-caseous nodules (fig. 13).

Here again it might be said that the tissue reaction had been modified in the direction of excessive fibrosis; but chemical examination of the lungs gives a silica content of only 0·15% to 0·19%, figures well within the normal limits, and pathologically the case appears to be, as the official Board decided, one of simple tuberculosis.

In a rather different category are those cases of fatal tuberculosis occurring in workers in industries in which silica is an accepted hazard. In some of these cases tuberculosis supervenes on a frank silicosis, and the diagnosis presents no difficulties. But in others the two processes seem to develop simultaneously; characteristic silicotic nodes are not formed, and only an excess of fibrous tissue in the tuberculous lesions suggests the influence of a pneumoconiotic factor.

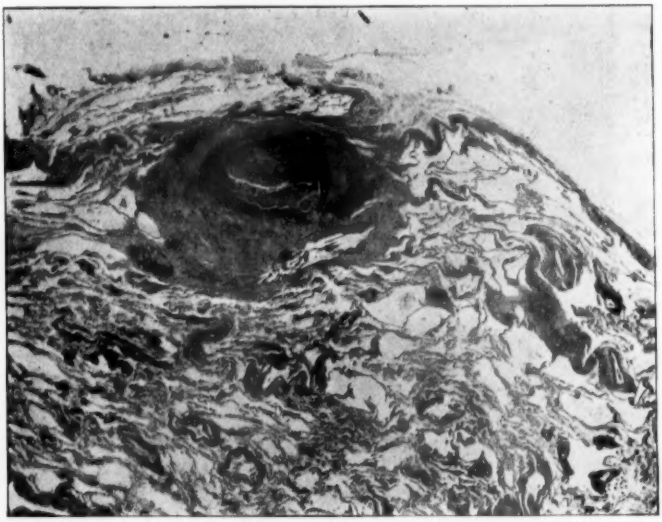

FIG. 13.—P. 46. Section of the lung showing fibro-caseous nodule.

An example of this type of case is seen in P. 19. The patient was a man aged 60, who had been employed for some forty years as a potter's placer in the jet and rockingham industry, though for considerable intervals during this time he had worked as a placer in a general earthenware industry in which he would have been exposed to a silica risk. The apex of the lung showed advanced fibroid tuberculosis (fig. 14), and here and there throughout the organ were small scars of healed tuberculosis. There had been an acute exacerbation of the disease in the form of an extensive confluent caseous tuberculous broncho-pneumonia, and these lesions contained enormous numbers of bacilli.

There are no definite silicotic nodules, and unless the apical fibrosis is regarded as unusually abundant, there is very little evidence of silicosis; there is, in fact, no very striking difference between these lesions and those found at the apices of the lungs in the next case.

P. 25, a man aged 39, died from Addison's disease. In this case both apices showed extensive chronic tuberculosis (fig. 15); the lesions were firm and fibrotic and heavily pigmented.

Histologically, the two cases are very similar. In P. 19 the fibroid areas are larger, and there is a rather more intimate mingling of the collagen and caseous material, while in P. 25 the histology is more definitely tuberculous and there is perhaps a greater tendency for the fibrous tissue to surround rather than to

penetrate into the caseous areas; but the differences are not pronounced. Nevertheless, chemical analyses give a silica content of 0·72% of the dried lung in P. 19, whereas P. 25 contains only 0·219%, and on these grounds one is justified in calling P. 19 a case of tuberculo-silicosis.

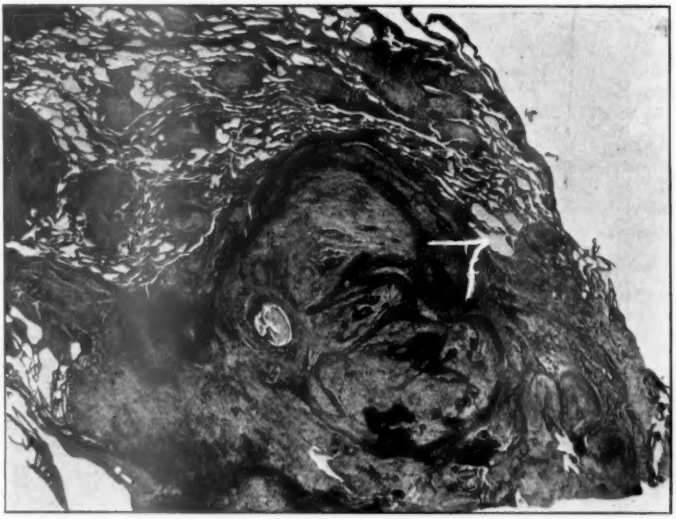

FIG. 14.—P. 19. Section of lung showing fibro-caseous tuberculosis (infective silicosis).

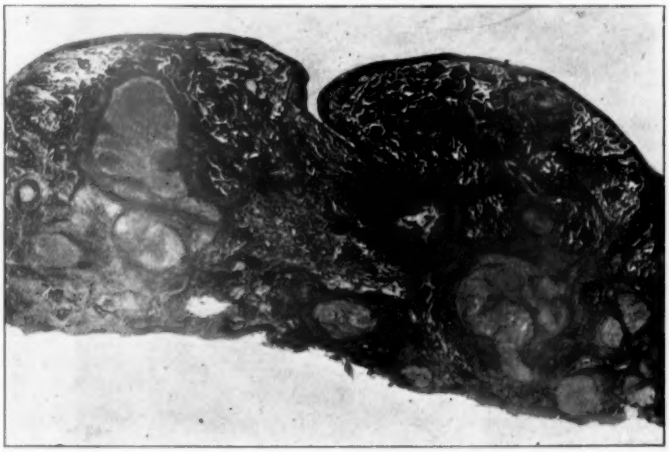

FIG. 15.—P. 25. Section of the lung in a case of Addison's disease showing fibro-caseous tuberculosis. Cf. fig. 14.

The practical difficulties with which one may be confronted in this kind of work are illustrated in the next three cases.

P. 37, a girl aged 18, had been engaged in an abrasive soap factory. She died from frank abdominal and pulmonary tuberculosis, about which there was no dispute, but two authorities have expressed the opinion that the gland at the root of the lungs was silicotic.

Fig. 16 is a low-power photograph of a root-gland and the details of the lesion are shown in fig. 17. The lesion is nodular and presents a definite amount of fibrosis, but no more, we would suggest, than may be found in uncomplicated tuberculosis, and this view is corroborated by the chemical analysis, for the root-glands contained

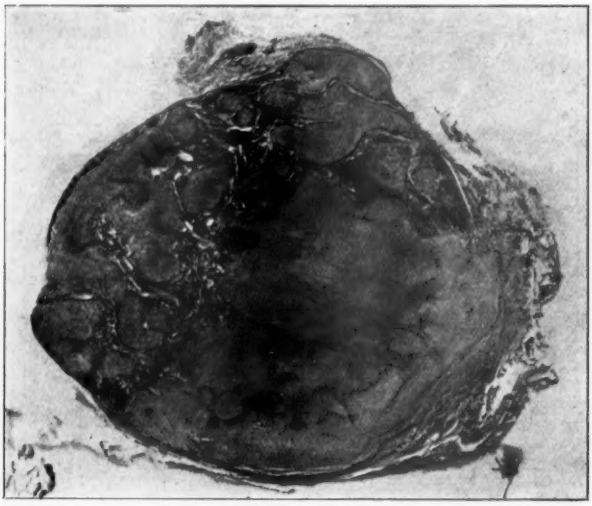

FIG. 16.—P. 37. Section of a gland from the root of the lung showing nodular tuberculous lesions.

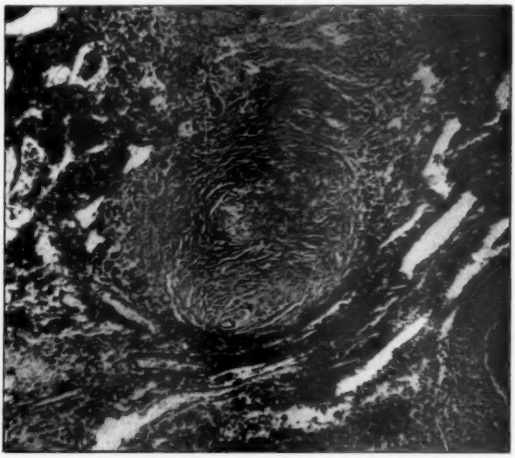

Fig. 17.—P. 37. A high-power photograph of one of the nodules illustrated in fig. 16, showing fibro-caseous structure which simulates infective silicosis.

less than 0·01% of silica and the dried lung only 0·09%. Ordinary pulmonary silicotic lesions could scarcely be expected in a person of this age with only a relatively short industrial history, but the earliest pneumoconiotic lesions are usually found in the root-glands, and silicosis here implies the presence of dust in the lungs.

And since it is generally agreed that pulmonary tuberculosis is liable to progress with unusual rapidity in the presence of silica dust, it might have been argued that this worker's illness developed as the result of her occupation. As a matter of fact, there was no claim for compensation in this case, but had one been made, it might, in the absence of a chemical analysis, have been extremely difficult to arrive at an agreed decision.

A similar difficulty arose in the next case, P. 6, a young man also employed in an abrasive soap factory. Here the lungs showed an advanced degree of tuberculosis, with extensive cavity formation. No true silicosis can be made out on microscopic examination, the nearest approach to it being the fibro-caseous lesions illustrated in fig. 18.

No chemical analysis was made in this case. On the facts available there would not seem to be any justification for regarding it as anything more than simple tuberculosis.

The last preparation, P. 9, was made from the lung of a sandblaster. The man's exposure to dust was a short one, extending only over five years, during which time he was employed intermittently for some four or five hours a week etching glass bottles. Sand-

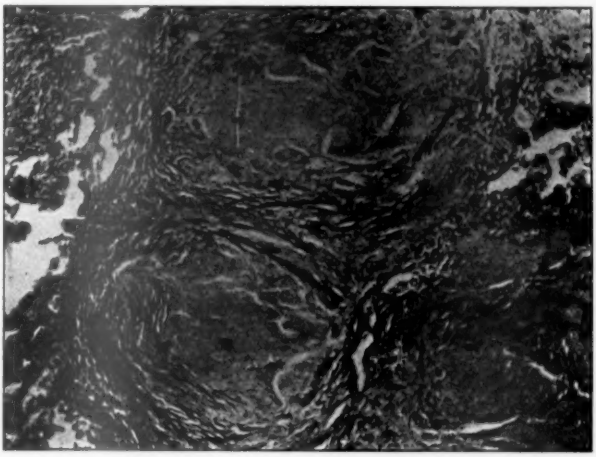

FIG. 18.—P. 6. Photomicrograph of section of the lung showing a fibro-caseous lesion, ? infective silicosis.

blasting is, however, recognized as one of the few industries in which silicosis is prone to develop rapidly.

We received only small fragments of the lung, not enough for chemical analysis. Microscopically, the changes are those of acute tuberculous broncho-pneumonia. There are a few fibro-caseous areas present (fig. 19) and whether or not these are regarded as manifestations of "infective silicosis" depends on the meaning attached to the term "excessive fibrosis."

CONCLUSION.

In the light of the examples we have brought forward it will be agreed, we think, that the diagnosis of tuberculo-silicosis is by no means as simple as is commonly supposed. We have no wish to exaggerate the difficulties, and we have by no means exhausted our material; we could have brought forward many other examples, and, on the other hand, have quoted cases in which we should have been prepared, on histological and chemical grounds, to diagnose tuberculo-silicosis in the face of expert opinion to the contrary. There is, of course, a world of difference between an ordinary tuberculous lesion and the laminated nodule of typical silicosis, and as a rule there is little difficulty in recognizing the presence of the two factors in a

combined tuberculo-silicosis; and even in the more difficult cases a careful microscopic examination will often reveal finer points of diagnostic importance to which we have not drawn attention. In making a diagnosis all the available evidence must be taken into account. A naked-eye examination of the lungs to determine the extent and distribution of the lesions is of the greatest importance; and due regard must be paid to the clinical and radiological findings, and to the patient's occupational history, particularly with reference to the atmospheric dusts to which he may have been exposed. A consideration of all these factors will often be sufficient, but in some cases it will be necessary to resort to a microscopic study of the lesions, and it is here that the difficulty arises.

The differential diagnosis depends on the amount and distribution of collagen in the tissue reaction; it is a matter of degree, and there are no definite standards on which to base an opinion. Recognized authorities may well differ in their interpretation of microscopic preparations and it is scarcely necessary to stress the undesirability of such a state of uncertainty in matters which may involve compensation and legal actions.

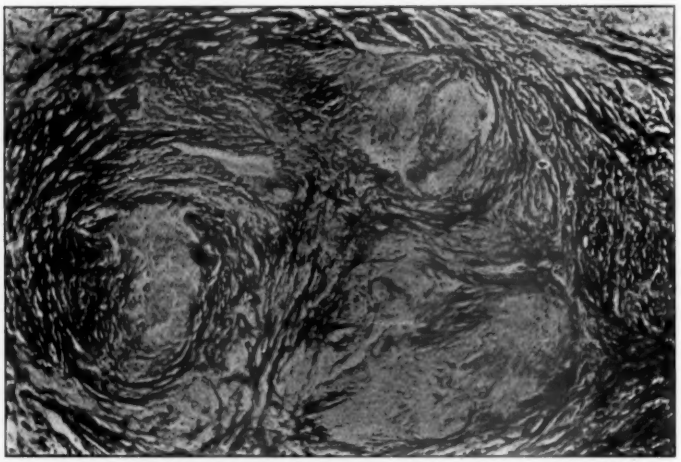

FIG. 19.—P. 9. Photomicrograph of a section of the lung showing one of the fibro-caseous areas.

Our investigations suggest that a chemical analysis may prove to be of great assistance in solving the difficulties. We are fully aware of the fallacies inherent in the method, and we do not suggest for a moment that it should be used to replace other means of diagnosis: but in conjunction with them it may be of great help in the estimation of the significance of pulmonary fibrosis, and it may well prove to be the deciding factor in determining, in the absence of a typical fibrosis, whether or not tuberculosis of the lung may be regarded as an occupational disease.

[The expenses of this work were defrayed by a grant from the Medical Research Council, from whom one of us (H. E. Archer) receives a personal grant. We are also greatly indebted to our colleague, Dr. A. H. T. Robb-Smith, for the photomicrographs which illustrate this article.]

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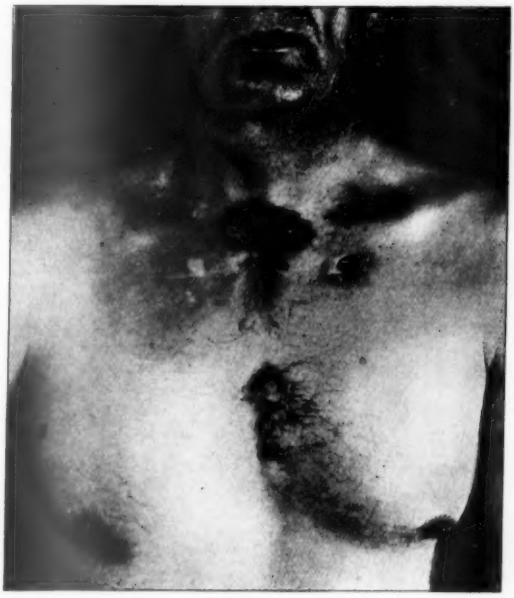
Clinical Section.

President—BERNARD MYERS, C.M.G., M.D.

[*March* 10, 1933.]

Tuberculous Disease of the Sternum.—CECIL P. G. WAKELEY, F.R.C.S.

William H., aged 54, has suffered from tuberculous disease of the sternum for thirty-seven years. In 1896 he was admitted to St. Thomas's Hospital with a swelling over the upper part of the sternum the size of a hen's egg. This was opened in two places—at the top of the sternum and at its mid-point—and drainage was instituted. The material removed from the swelling was found on microscopical examination to be tuberculous. The openings gradually healed and the patient was discharged. Seventeen years ago a swelling appeared on the right shoulder and this



Tuberculous disease of the manubrium sterni.

was drained. Five years ago a chain of glands in the right side of the neck became enlarged and broke down and discharged thick yellow pus intermittently for five months.

One year ago the scar at the upper end of the sternum broke down and discharged a thin watery fluid, and healing has never taken place. At present there is a dry ulcerative area at the upper part of the manubrium, about the size of a penny (see figure). The glands in both anterior triangles of the neck are enlarged and a tuberculous abscess was opened in the right axilla on March 3, 1933.

X-ray examination of the chest reveals old healed apical tuberculosis. There is no sign of any active disease in the sternum itself. The general condition of the patient is quite good, he has an outdoor job and his weight remains constant.

Mr. ROCYN JONES said that this patient was favoured with a considerable resistance to his disease seeing that it had been present since 1896, and had interfered very little with his earning a livelihood. Mainly for that reason he agreed with Mr. Wakeley in not attempting a radical removal of the diseased area of the sternum. The cervical glands were probably chronically inflamed and enlarged because of ordinary pyogenic infection. He would, however, suggest treating the ulcerative lesion of the skin by light exposure as in the case of lupus, but he would not advise X-ray therapy because there were serious risks in this form of treatment if applied in this case.

Carcinoma of the Testicle with Inguinal Glandular Involvement.—CECIL P. G. WAKELEY, F.R.C.S.

Thomas B., aged 38, first noticed that his right testicle became swollen seven or eight years ago. No history of trauma. The testicle remained about the same size until about two months ago, since when it has become slightly larger, but is not painful.

About four years ago the patient noticed hard nodules in the right groin occurring in the vicinity of a hernia scar. These nodules were hard but not painful, and did not tend to increase in size until two months ago. The swelling in the groin has now become much larger, is occasionally painful, and has begun to ulcerate. About two months ago the right leg became swollen and has gradually increased in size; it is now about three times the size of the left leg.

Carcinoma of right testicle with involvement of the inguinal glands causing massive œdema of the right leg.

The patient was operated upon for a right inguinal hernia in 1914 in Salisbury Infirmary. He was operated upon in 1927 for appendicitis at the Andover War Memorial Hospital, and for gallstones in 1930 at the same hospital. No history of venereal disease. No relevant family history.

On examination.—The right half of the scrotum is drawn up and filled with a hard growth about the size of an orange. The skin can be moved over the surface of the growth, but the growth itself is attached to the pubis. The right inguinal glands are matted together into a hard fixed lump from which there is a prolongation round the inner side of the right thigh (see figure). The skin of the thigh is in places ulcerated. There are some small discrete hard glands in the left groin, and there is well-marked solid œdema of the leg and thigh.

Mr. HAROLD EDWARDS said that the case presented two interesting features. Firstly, although the scrotal wall was not involved, spread had taken place to the inguinal lymphatic glands, and there was no evidence of involvement of the lumbar glands. Secondly, the growth was of comparatively low malignancy as far as could be judged from the length of the history, it being four years since the patient first noticed the swelling due to involvement of the inguinal glands. In view of these two facts—the absence of secondary deposits in the lumbar region, and the low degree of malignancy—the case should be regarded as operable. Excision of the inguinal glands might be combined with the use of radium or radon seeds.

Diverticulum of Second Part of Duodenum.—HAROLD EDWARDS, M.S.

Patient, a woman, aged 54, has suffered from attacks of epigastric pain, with occasional sickness, since last summer. The pain occurs shortly after the taking of food, but is not otherwise related. Flatulence has been a prominent and distressing symptom. Since 1913 she has been treated at intervals for ulcer of the stomach, and is said to have had a hæmatemesis on four occasions, but this cannot be verified. The appendix was removed in 1927.

A skiagram showed the stomach low in position, but no other abnormality. There was a large pouch opening from the second part of the duodenum, in which retention of barium occurred beyond twenty-four hours. Gastric residuum showed hypochlorhydria of moderate degree.

Operation.—The duodenum, gall-bladder and colon were held together by a broad membrane (? inflammatory). The stomach was large, but no ulceration was found. The duodenum and gall-bladder were separated (gall-bladder healthy) and an incision was made in the peritoneum between the two. The duodenum was then rotated to the left, and a large pouch exposed. This was freed, its pedicle was clamped, and it was removed. Abdomen closed without drainage.

Specimen.—The pouch has a thin wall devoid of a muscular coat; its cubic capacity is 14 c.c.

No other cause for the symptoms was found at operation. The stomach and duodenum were otherwise normal in appearance and the gall-bladder healthy. The appendix had been removed six years before. Insufficient time has elapsed since operation to say whether the symptoms have been permanently relieved.

The consensus of opinion with regard to the ætiology of diverticula of this type appears to be that a weak spot in the muscle wall is provided by the entry of the common bile-duct, and that intraduodenal pressure forces a mucous membrane hernia through this weak area.

Aberrant Great Vessels.—TERENCE EAST, D.M.

The patient, male, aged 44, shows large pulsating vessels at the root of the neck. Some of the branches of the aorta appear to be enlarged and in abnormal positions. The innominate artery is probably in an unusual situation. It is not thought that an aneurysm is present.

History of syphilis two years ago. The Wassermann reaction is negative. The pulses are equal and synchronous The blood-pressure ranges between 180/125 and 160/100.

A skiagram shows that the posterior part of the arch of the aorta is rather small (see figure). The heart is enlarged to the left (transverse diameter 14·5 cm.).

A mitral systolic murmur of long duration is heard at the apex of the heart. The left auricle is not prominent.

Diagnosis.—Congenital abnormality in the branches of the aorta.

Slight enlargement of the heart in the transverse diameter (high blood-pressure); unusually small aortic prominence on the left, considering the pressure and age. Suggestive of some abnormality in the aorta.

Combined Sclerosis treated by large doses of Iron.—WILFRED HARRIS, M.D., and WILLIAM SARGANT, B.Ch.

A forgeman in a railway works, aged 37, first noticed tingling in the fingers and toes in August, 1930, and six months later stiffness of the knees, especially in the morning, together with a girdle sensation. End of May, 1932, gave up work, feeling ill and weaker, and a month later complained of sluggishness of action of bowels and bladder, but never of incontinence.

July, 1932: Began to suffer from numbness of legs, and difficulty in walking, especially in the dark. Arms easily tired. Admitted to St. Mary's Hospital, August 23, 1932. Then quite unable to stand without assistance, left leg being weaker than right. All deep reflexes in arms and legs increased. Bilateral extensor plantars. Abdominal reflexes absent. Some diminution of sensation in the lower extremities as high as the lower abdomen. Loss of vibration sense in legs.

Blood examination.—Hb. 88%. C.I. 0·9. Cells normal in type. Cerebrospinal fluid normal in all respects, including the colloidal gold reaction. Fractional test meal showed complete achlorhydria.

Patient was treated by fifty grains of Blaud's pill three times daily, which he has continued up to the present. Very gradually the power of the legs increased, and

he was able to begin to walk with a wheeled support. He has made steady improvement ever since, and can now walk on a straight line alone. The plantar reflexes are still extensor.

Discussion.—Dr. WILLIAM SARGANT said that nine other patients with nervous phenomena and achlorhydria accompanied by varying types of anæmia, had also been treated with intensive iron therapy at St. Mary's Hospital. All showed a marked degree of improvement, similar to that in the case shown.[1] If an Addisonian anæmia accompanied the subacute combined degeneration, liver must be given as well as iron, in order to maintain the blood picture. As a result of experiment, however, iron had been shown to be capable of alleviating the nervous phenomena of Addisonian anæmias, despite a falling blood-count.

[A photograph of another patient's handwriting before and after iron treatment was shown, as added evidence of the neurological improvement that could be obtained by intensive iron therapy.]

Dr. WALTER CARR asked whether any disagreeable symptoms or consequences were caused by the large doses of iron given to the patient.

Dr. H. STANNUS said it would be interesting to hear Dr. Harris's views upon the nature of the changes in the spinal cord in these cases which cleared up under iron therapy. They presumably could not be those found after death and commonly written down as the pathological picture underlying the symptoms of combined sclerosis.

Dr. SARGANT (in reply) said that these large doses of iron did not cause undue intestinal upset. The Blaud's pill was best prescribed half an hour after meals, and preferably in capsules containing 17 grains each. No drastic aperients should be given or diarrhœa might result. The administration of iron must be permanent, and to lower the dose below 50 grains a day produced a recurrence of the symptoms. The addition of hydrochloric acid by mouth did not seem to be necessary.

It was impossible at present to say precisely in what way these very large doses of iron produced their effect on the central nervous system. An entirely new field of investigation had been opened up, and much patient research was still necessary.

Persistent Œdema of the Left Leg, with Anæmia.—F. PARKES WEBER, M.D.

The patient, K. L., a woman, aged 26, complains of persistent œdema of moderate degree in the left lower limb up to the knee, which commenced gradually in July, 1931. Since that time there has also been slight œdema in the right foot. There is also moderate anæmia, though the patient has been taking iron. Blood-count (February 22, 1933): Hæmoglobin 68%; erythrocytes 3,400,000; colour-index =1·0; leucocytes 12,600 (polymorphonuclear neutrophils 64%; lymphocytes 30%; monocytes 6%). Brachial blood-pressure: 120/65 mm. Hg. Urine free from albumin, sugar and excess of urobilinogen. There are some decayed teeth. The blood-serum gives negative Wassermann and Meinicke reactions. Menstruation commenced at 14½ years and was apparently regular and not deficient in amount till the age of 21 years, since when it has been scanty and often absent for two or three months at a time. By ordinary examination there is no evidence of any disease in the abdominal or thoracic organs or lymph-glands. Nor is there any history of chronic œdema in other members of the family. The first question is whether the œdema is of the Milroy-Nonne developmental type, although there is no familial history, or whether it is in some way connected with the anæmia. There is also the

[1] W. Sargant, *Lancet*, 1932 (ii), 1322.

question whether the habitual wearing of a long corset has played any part in the production of the anæmia.

Fractional examination of the gastric contents shows no achlorhydria or hypochlorhydria.

Paralysis of the Left Leg, with tendency to Choreiform Movements in both Hands.—F. PARKES WEBER, M.D.

The patient, E. S., a woman, aged 20, is said to have been normal till June, 1929, when, on account of some illness of unknown nature, she had to remain three weeks in bed. During this illness her left lower limb became paralysed, and the paralysis has persisted since then. The left foot and lower part of the leg are often cold and cyanotic, and there is hypo-æsthesia up to the knee; the patellar and Achilles reflexes are present. Since the illness she has developed a marked tendency to fidgety choreiform movements in both hands, which, however, she can use for writing, knitting, &c. Otherwise nothing abnormal has been found by ordinary, including ophthalmoscopic, examination. The blood-serum gives negative Wassermann and Meinicke reactions. She is right-handed. There is nothing special in the family history

At the meeting opinion seemed to favour an encephalitic origin.

Calcification and Tortuosity of the descending Aorta, and Aneurysm of the Aortic Arch. Tabes Dorsalis.—GEOFFREY KONSTAM, M.D.

S. R., male, aged 60. First seen January 30, 1933. Complained of giddiness and frontal headaches of three weeks' duration. Five weeks ago he had an attack of abdominal pain accompanied by vomiting.

On examination.—Bilateral Argyll-Robertson pupils, knee-jerks present, both ankle-jerks sluggish, right greater than left. No Rombergism. Vibration sense, joint sense, and deep muscle sense, unimpaired. Radial arteries thickened; blood-pressure 200/110. Pulse regular; apex beat quarter of an inch external to the left nipple line. The second sound in the aortic area is much accentuated. Blood Wassermann reaction positive.

Electrocardiogram.—Normal rhythm, left ventricular predominance.

Antero-posterior skiagram of the chest shows a fusiform aneurysm of the aortic arch. In a skiagram taken in the left anterior oblique position the descending aorta is seen to be calcified and unusually tortuous.

Dr. PARKES WEBER said he believed that syphilitic aortitis favoured calcification, just as non-syphilitic arteriosclerosis did. In both cases, owing to stenosis of the vasa vasorum, an ischæmic condition was produced, and calcareous deposition occurred in necrotic or semi-necrotic tissue, whether the necrotic process was due to ischæmia or to any other cause.

Addison's Disease.—HUGH S. STANNUS, M.D.

M. G., male, aged 21, French. Nothing of importance in family or past history: no history of tuberculosis. In youth, though patient is of a dark-haired, brown-eyed type, his skin was fair.

Pigmentation of the skin began about five or six years ago and has been progressive until the present time, though it has been thought that some periodic variations in the depth of the tint have occurred.

In September, 1931, he began his military service in the French Army (Strasbourg) and was at that time well and able to carry out his duties. About

a year later (August, 1932) he began to feel weak and tired and lost appetite and weight. September 4, 1932, he was admitted to a military hospital. There he had giddiness, was somnolent and slept a great deal and had two attacks of abdominal pain and vomiting simulating appendicitis. There was a total loss of 2 stone in weight. The blood-pressure was so low—it is stated—that readings could not be taken, but some improvement resulted from the administration of adrenalin—40 drops in water being taken in divided doses throughout the 24 hours. November 29, 1932: Discharged from the Army and joined his brother in England. January 20, 1932: Had an attack of syncope and was admitted to the Mile End Hospital where he improved after 10% intravenous glucose. The blood-pressure was then 75/42 and blood-sugar 88·9 mgm. %.

Intravenous injections daily of eucortone, 15 c.c. as a first dose, were begun February 1, 1932, with immediate improvement; the appetite was better, nausea disappeared, and the patient felt brighter. Blood-pressure 85/50.

On February 6, 1933, he was transferred to the French Hospital. He presents the typical pigmentation of the skin, gums, and buccal mucous membrane of Addison's disease. There are a few spots of darker pigmentation on the face and back, but no areas of leucoderma. The fundi exhibit a slate-grey hue such as is seen in dark-skinned races. He might easily be taken for an Indian. A linear streak of lighter colour should, however, be remarked on either side of the chest symmetrically running from the nipple to the sternal notch. Weight 118 lb. Beyond the low blood-pressure (78/43 to 88/56) and feeble cardiac sounds, a kypho-scoliosis, muscular weakness, and some brittleness of the nails, there are no physical signs to be recorded. Temperature normal. Pulse 84 per minute. Laboratory investigations (Dr. Schwabacher) show: Blood-count R.B.C. 6,010,000; Hb. 94%; C.I. 0·78; W.B.C. 6,800. *Differential*: Polys. 43·2%; lymphos. 51·2%; eosinos. 5·6%; Meinicke reaction negative. Blood-urea 40 mgm. %. Urine normal.

Blood-sugar, fasting and twenty-four hours after an injection of eucortone, 72 mgm.%; after 50 grm. dextrose, half-hourly readings gave the figures 109, 83, 72 and 80. Eucortone was discontinued for ninety-six hours: the blood-sugar was then 80; the patient felt very weak and fainted, blood-pressure 78/50. 5 c.c. eucortone injected, at the same time 50 grm. dextrose given; half-hour estimations of blood-sugar yielded following results: 117, 113, 94, 68, 78—a lag curve with excessive excretion. A Mantoux test gave a marked positive reaction, with vesicle formation, followed by persistent thickening, in dilution 1 : 10,000. The results with dilutions 1 : 100,000 and 1 : 1,000,000 were negative. There was a marked general reaction—the temperature rising to 103·8° F., pulse 112 per minute with headache, the patient being normal again in five days. There was no focal reaction.

He has received 5 c.c. eucortone daily intravenously. Readings taken at ten-minute intervals after the injection show no rise in blood-pressure, which has remained at about 88/50 to 78/40.

POSTSCRIPT, 21.4.33.—During the past week a few striæ atrophicæ have appeared in the skin over the most prominent part of the dorsal curvature on each side of the vertebral column.

Discussion.—Dr. BERNARD MYERS: Concerning the low blood-pressure, I would suggest that, in addition to the present treatment, the patient should have one or two—or even three—grains of whole gland pituitary dried extract daily. In several instances low blood-pressure has been distinctly raised by this treatment, and where it acts the only point that needs watching is to give the exact dose which will keep the blood-pressure at the desired level.

Dr. PARKES WEBER said that the recent development of cutaneous "striæ atrophicæ" without distension of the skin entirely supported views on the subject which he (Dr. Weber)

had previously expressed. In such cases there were (1) a predisposing or constitutional cause, and (2) an exciting cause. In the present case the predisposing cause was the cachectic condition of Addison's disease, which doubtless diminished the normal elasticity of the skin, somewhat as typhoid fever did. The exciting cause in the present case was the moderate stretching of the skin over the middle of the back due to the patient's favourite position in bed, i.e., sitting up with bent (very convex) back.

CORRIGENDUM.

Vol. xxvi, p. 529 (Clinical Section, p. 59), 9th line: for 5/1065 mm., read 105/65 mm.

Section of Dermatology.

President—A. M. H. GRAY, C.B.E., M.D.

[*February* 16, 1933.]

Pityriasis Rubra Pilaris.—H. W. BARBER, M.B.

This patient, R. H., aged 29, has, I believe, already been shown before the Section by Dr. Roxburgh. The eruption began on the hands and feet when he was aged 14, then appeared on the buttocks, and later on the arms. It seems to have remained stationary until recently, but after a course of ultra-violet radiation fresh areas have become involved, notably on the back, chest, thighs and arms. He was referred to me by one of the staff of the clinic at which he was receiving light treatment.

The involvement of the palms and soles with a diffuse hyperkeratotic erythrodermia, and the follicular horny plugs on the backs of the fingers and fronts of the wrists are characteristic. The nails are affected, and the face also, to a slight extent.

Intradermal tests made for me by Dr. Shone, with human, and with bovine tuberculin, elicited moderately positive reactions, particularly with the latter.

At a recent meeting of the Section, a case of this disease was shown, and some doubt existed as to the prognosis. I have had several cases under observation during the past ten years, and my experience is as follows :—

(1) The eruption may appear acutely, sometimes, as in psoriasis, after tonsillitis. In one case it followed immediately after sun-burn resulting from a long afternoon's tennis. In the early stages it is often at first diagnosed as psoriasis, which it may closely resemble. The early involvement of the palms and soles, however, is the rule, and should guide one to the correct diagnosis.

(2) In other cases the onset is insidious and the eruption localized, but, as in the present case, the palms and soles are usually affected early.

(3) In acute cases the eruption may spread rapidly, and the entire skin, including the face and scalp, may become involved in a few weeks, a generalized erythrodermia with ectropion resulting. This may persist for a few months, and then clear up entirely. One small boy under my care had two separate attacks of this kind, each lasting three or four months. On the other hand, recovery may be partial, the palms and soles in particular remaining affected, but these, too, eventually tend to clear.

(4) In other cases the eruption may become very widespread, though not generalized, and remain more or less unchanged for years, but in the majority ultimate recovery is the rule. One woman was under my care for seven years, but is now well.

(5) I have never convinced myself that any of the numerous methods of treatment that I have tried has had any influence whatever upon the course of the disease.

Sir ERNEST GRAHAM-LITTLE said he thought that the experience of most of those present would support Dr. Barber's summary. He could himself quote an extensive case, in which the condition had disappeared without treatment. He agreed that treatment—at all events local treatment—did not appear to be of much use, but many years ago his impression was that he had cleared up a very extensive eruption by means of thyroid administration.

Psoriasis, Leucoplakia and Black Hairy Tongue.—H. W. BARBER, M.B.

The patient, H. F., aged 45, was referred to me on January 10, 1933, by a dental surgeon for an opinion on the leukoplakia of his hard palate, which had been present for about eighteen months. He has had psoriasis for fourteen years, but cannot say for how long the condition of his tongue has been present.

On examination, I found the hard palate covered with a thick accumulation of whitish "scales," the more superficial layers of which could be easily scraped away: the posterior part of the tongue presented the characteristic appearances of the so-called "black hairy tongue." On the skin of the body and limbs there was a widespread psoriasis of the superficial type.

The patient has in the past been a heavy pipe-smoker, but fifteen months ago he gave up the habit, and now only smokes a few cigarettes daily.

The Wassermann reaction was completely negative.

The condition of the hard palate is of interest. I am very doubtful whether it can be accounted for by smoking: certainly it did not improve after the patient abandoned his pipe. During the past few weeks it has improved very strikingly, apparently owing to his sucking some proprietary lozenges, the composition of which I do not know, and when I saw him on February 8 a great deal of the heaped-up epithelial scales had disappeared.

It is tempting to suggest that the condition may be psoriasis affecting the mucous membrane, though I have never previously noted lesions of the buccal mucous membrane associated with psoriasis.

Discussion.—Dr. I. MUENDE said that at Dr. Barber's request he had made cultures from the tongue and the hard palate because in a few cases of hairy tongue an infective organism of a type belonging to the monilia group had been found. The organism isolated from this case was described by Sir Aldo Castellani as *Monilia meta-tropicalis*, a rare variety of the moniliæ. He (the speaker) had made cultures from the lesion on the palate, but no monilia was found.

The question of hairy tongue being due to infection was an interesting one, because Dr. Barber had had three cases, and in all of them monilia was present, though they were of different species: one was *Monilia meta-tropicalis*, one was *Monilia krusei*, the other *Monilia pinoyi*. These organisms were not so common on the ordinary tongue as was often thought; he formed this conclusion as a result of examining cleaned normal tongues.

Dr. R. KLABER said that he had investigated six cases of black hairy tongue, and in all had found a yeast-like organism and a thread-like organism. Each of these had been described under a variety of names. They were practically constant findings in this condition, but it was difficult to regard them as in any way causative. He had performed a biopsy on a black hairy tongue and had compared the histological appearance with that of post-mortem sections of heavily furred ordinary tongues. It was difficult to distinguish between them. The "hairiness" was clearly due to overgrowth of filiform papillæ, which were densely covered by the thread-like organisms. In culture the "yeast" formed large colonies which overgrew the tiny colonies of the thread-like organisms. The latter were difficult to identify, as they might take a week to make their appearance, but they only grew at a temperature of 37° C., whereas the "yeast" grew at ordinary room temperature. He agreed that the finding of these so-called "moniliæ" on a normal, clean tongue was uncommon, but he had obtained a profuse growth of similar organisms from tongues covered by much ordinary white or brown fur.

Dr. G. B. DOWLING said that on one occasion, on direct microscopical examination, in a case of black tongue, which was at the same time the seat of a carcinoma, he had found the filiform processes to be stuffed with spores, the appearances recalling those of hairs infected with a microsporon.

Dr. W. N. GOLDSMITH said that some years ago he had a series of cases of black hairy tongue, one of which was shown at a meeting of this Section in March, 1928.[1] Their

[1] *Proceedings*, 1928, xxi, 1429 (Sect. Derm. 63).

bacteriology was investigated by Dr. Ralph, and in all except one the organisms described by Dr. Klaber were found. As a rule these organisms were not found in the normal mouth. In the case which he had shown, however, they were found constantly for many months after the disease was clinically cured. This showed that the presence of hypertrophied papillæ was not necessary for the growth of the organisms. On the other hand, the fact that they were not found in one case of clinically similar black hairy tongue showed that, in that instance at least, the condition was brought about by something other than the organisms. It was always possible to separate culturally the cryptococcus from the thread-like nocardia, but the latter could not be obtained in pure culture without the cryptococcus. Possibly they were forms of but one organism, though the threads were extremely fine for a monilia.

Pityriasis Lichenoides et Varioliformis Acuta.—H. W. BARBER, M.B.

A. J. F., male, aged 17, sent to me on February 6, when the eruption had been present for three weeks.

The distribution is unusual, as the face, neck, arms and thighs are the parts chiefly affected, the trunk being relatively free.

Discussion.—Dr. W. N. GOLDSMITH said he agreed that this was pityriasis lichenoides et varioliformis acuta, or rather, sub-acuta. The distribution was certainly remarkable; it was exactly opposite to the distribution in the last case he had seen, which was one of a typical eruption in a child, who had recently been a good deal exposed to the sun in a bathing-suit. The eruption was profuse in the area covered by the bathing suit and ceased abruptly at the neck and the knees, the exposed parts being absolutely free. So obvious was it that light was playing a part that he ordered carbon arc light baths and the whole condition quickly resolved. It occasionally happened that a disease assumed a distribution which was not only unusual, but the exact opposite of the classical one. He had, for instance, seen pityriasis rosea affecting the forearms and the lower part of the legs, the body being quite free. The individual lesions were so characteristic that the diagnosis was not in doubt.

Dr. BARBER (in reply) said that undoubtedly pityriasis lichenoides acuta, with or without varicelliform lesions, and pityriasis rosea must be specific infections. Dr. Knowsley Sibley had shown a case of the former, in which there appeared to be a "herald" patch, as in pityriasis rosea. Exposure to light appeared to influence the latter too; the eruption affected chiefly the covered parts of the body, and its course was shortened by ultra-violet radiation.

Hyperkeratosis of the Soles.—ELIZABETH HUNT, M.D.

U. K., a married woman, aged 47.

History.—The condition began two years ago on the heels, then spread to the toes and later under the soles, one foot became septic, and the patient attended a foot clinic.

During the last six months a rash, which has been very irritable, has spread from the feet to the legs, the lower abdomen, and the arms.

Present condition.—The feet are symmetrically affected. There is marked thickening of the horny layer beneath the heels, under the outer borders of the feet, and beneath the meta-tarso-phalangeal joints, but the hollows of the feet are unaffected. Small irregular patches, with horny scales, surrounded by normal skin are present on the plantar surfaces of the terminal phalanges of some of the toes. The nails are thickened and opaque and are raised up by the horny débris underneath. The skin in the inter-digital clefts is white and sodden, and the contiguous surfaces of all the toes show a raw, oozing condition. No fungus has been detected by microscopical examination. On the legs, thighs, lower abdomen, and arms erythematous patches of varying shapes and sizes are present, some of which show fine scaling at well-defined borders; other patches fade at the margin into normal skin. The fronts of the knees are rough and show psoriasiform lesions. The hands are unaffected.

The main points in the medical history are rheumatic fever at the age of 21, and frequent rheumatic trouble and headaches. The climacteric occurred at the age of 38.

There has been nothing in the history to suggest any infection by the gonococcus. No proof of mycotic infection is forthcoming. There is no history of psoriasis, but the lesions on the knees are like chronic psoriasis patches at that site, and the question arises whether this is a case of psoriasis of the soles of the feet.

Eruption on Cheek: Case for Diagnosis.—ELIZABETH HUNT, M.D.

J. B., a girl aged 6, has a lesion on the cheek below the outer canthus of the right eye, which she has had for two years.

Present condition.—The lesion is oval in shape, about half an inch in its longest diameter, and slightly raised above the level of the skin. It is flat-topped, fawn-coloured and has a moderately rough surface.

History.—For many months now it has been stationary in size, but the child's mother says that it began as a small spot like a flat wart and grew rapidly at first; there has never been more than one wart. It began when the child was much debilitated and suffering from cervical adenitis following measles and whooping cough.

Comment.—The lesion seems unusual in size and in site for a common wart, and it has not responded in any marked degree to keratolytics. If it had arisen as the coalescence of numerous flat warts one would expect that more than one lesion would have been observed.

The possibility of the condition being a granuloma annulare suggested itself as I have observed recently in several instances typical lesions of granuloma annulare in children who do not make a good recovery after measles and whooping-cough, and in this child's case there is an added history of close association with a relative who recently died from phthisis.

Discussion.—Dr. J. A. DRAKE suggested that the lesion on the child's face was a mole.

Dr. A. C. ROXBURGH said he thought that the lesion on the face was a very large plane wart.

Infantile Trichotillomania.—A. BURROWS, M.D. (for Dr. W. J. O'DONOVAN).

Sydney M. (male), aged 3 years.

One or two members of this Section have previously described cases of trichotillomania. The main interest to this case is the fact that the patient is an infant. Dr. Maitland Jones, to whom I showed the patient, was of the opinion that the child is not suffering from a disease, but a defect of conduct.

In this case the child wets its fingers, plucks out the hair, examines the plucked hair, and throws it away. This condition has persisted for fifteen months. I have written to the Superintendent of the Zoological Society Gardens, inquiring if this habit is present to any extent among the higher apes or monkeys. Mr. G. M. Vevers kindly replies as follows:—

"Your case of hair-plucking sounds extremely interesting. Neither I nor any of my colleagues have ever noticed anything of the same nature amongst the Primates.

"The common habit which monkeys have of searching their own and others' coats does not include the pulling out of any hair or even a search for parasites, as monkeys are particularly free from these, but is a natural search after small particles of skin and scurf, which apparently have a salty flavour."

To break the habit, as far as I can make out, there are three possible lines of procedure: (1) To encase the arms in splints, cardboard or otherwise; (2) To

fit firmly a cap like a motor-cyclist's helmet to the head; or (3) To keep the head shaven for some time until the habit is broken. The last method seems the best.

I am interested to know if there is any better procedure, or which is the best of these, and I should also be glad if any member of the Section knows how

Infantile trichotillomania.

long the condition is likely to persist, and if other bad habits are likely to develop. The child at present sucks his thumb. Mentally he seems normal, but he is rather restless. He is the sixth of a family of seven.

Discussion.—Dr. J. D. ROLLESTON said that when he was President of the Section for the Study of Disease in Children, he had shown a case of trichotillomania in a boy aged 10,[1] who was backward both mentally and physically. It was of special interest, as it was the only one that he could find in the literature in which the condition had followed an acute infection, in this case typhoid fever. Most of the early cases first described by Hallopeau had occurred in adults, but a certain number were in children, though few in English children. Cruchet, of Bordeaux, had described cases in association with other tics. One was peotillomania (plucking of the penis), and others were cases associated with sexual perversion. He (the speaker) did not know whether the sucking of the thumb in the present case would be regarded by Freudians as a sexual perversion.

Dr. HALDIN-DAVIS said that in 1914 he had reported an epidemic of hair-pulling in an orphanage,[2] in which two or three genuine cases of alopecia areata had occurred. The children who had alopecia had become the central figures in the institution and the others, in order to attract attention to themselves, had taken to hair-pulling. That, of course, was an example of pathomimesis.

Dr. I. M. GADDUM said she had treated a child, aged 18 months, with the same condition. Its head was shaved, and it sucked its thumb a good deal. When the hair was allowed to grow again there were no signs of a return of the habit.

1 1927, xxi, 1187 (Sect. Dis. in Child., 27).

2 *Brit. Journ. Derm.*, 1914, xxvi, 207-210.

Dr. SYDNEY THOMSON said that he had had a case of the kind, in which three months of shaving broke the habit, but, as children easily formed and lost habits, he doubted whether shaving for three months was necessary; it could be tried first for a month. If a child could not pull out its hair it would probably acquire other habits.

Acrodermatitis Chronica Atrophicans: Case for Diagnosis. — A. C. ROXBURGH, M.D.

Patient, male, aged 45, mining and oil engineer, complains of red patches on the legs of some years' duration; there is also tinea between the toes.

History.—Has been abroad for many years in places where leprosy is endemic, such as South Africa, Colombia and Venezuela.

In 1927 had "malaria" badly. Noticed for the first time "roughness of skin with red spots" about the ankles, but not elsewhere. The condition resembled "chapped skin."

In 1928 condition "more like prickly heat," but still confined to ankles.

In the middle of 1931, patches suddenly increased and became more definite. If not kept greasy with ointment they became scaly and irritable.

Present condition.—Healthy looking man with a dusky-red, slightly shiny, and very slightly scaly area 4 by 5 in. in diameter below the right inner malleolus. This is the oldest lesion. Separated from this by a narrow band of depigmented but otherwise normal skin is a rather paler area measuring 8 by 6 in. and covering the inner side of the leg. The affected skin is very slightly infiltrated and the epidermis shows some "cigarette-paper wrinkling." Below the patch on the inner side of this ankle there appears to be some depigmentation. On the outer side of the left ankle there is a similar patch measuring 5 by 3 in. with a little depigmentation below it. On the back of the left calf are the most recent areas which are irregular in size and shape, but all have definite margins and are characterized by redness of the follicles upon them. The only alteration of sensation which can be detected is a definite hyperæsthesia to light scratching with a pin on the new areas on the back of the left calf. No anæsthesia can be detected at all, although there is possibly some slight dulling of thermal sensation on the oldest lesion. The rest of the skin appears to be healthy except that there is general flushing of the skin of the upper trunk with reddened follicles. Mucous membrane of mouth healthy. No enlarged lymph-glands can be found anywhere, nor any thickening of superficial nerves, e.g. ulnar or peroneal.

Pathological examinations (Dr. Robert Klaber).—*Epidermophyton rubrum* (Castellani, 1909) found in scrapings from between fourth and fifth toes, both feet. No fungus or acid-fast bacilli seen in scrapings from margin of patch on leg. No acid-fast bacilli seen in smears from both sides of nasal septum.

Wassermann reaction negative (Dr. Archer).

Blood-count: R.B.C. 5,350,000 per c.mm.; Hb. 93%; C.I. 0·9; W.B.C. 3,800 per c.mm.

Differential	Per cent.	Per c.mm.
Polymorphs	68 ...	2,584
Lymphocytes	19 ...	722
Monocytes	11 ...	418
Eosinophils	1 ...	38
Basophils	1 ...	38

There is a polymorph and lymphocyte leucopenia, with a monocyte increase. No abnormal red cells, or parasites, seen.

Report on examination of sections.—Biopsy was performed on the upper margin of the erythematous circle on the inner aspect of the right ankle. Epithelium is thick though flat without any papillary processes, otherwise appears normal.

Corium: The collagenous matrix shows œdema and stains poorly (Van Giesen). There is great destruction of elastic tissue, including that normally surrounding the

sweat-glands (Weigert). There is an increased cell-infiltrate which is chiefly perivascular, and consists of small round cells, large pale swollen connective tissue-cells and an occasional mast-cell. A similar infiltrate involves the periphery of the sweat-glands and the deep border of what appears to be an œdematous arrector pili muscle. The vessels show a greatly swollen endothelium. Serial sections stained by a modified Ziehl-Neelsen technique using 1% acid alcohol, only, for decolorizing, showed no acid-fast bacilli.

Opinion.—Non-specific chronic inflammation.

With the patient's history it is obviously necessary to consider the possibility of leprosy rather carefully but I think we have excluded this disease. The diagnosis seems to me very obscure but some members of the Section think that the disease is probably acrodermatitis chronica atrophicans, though the suggestion of epidermophytide has also been made.

Discussion.—Dr. PARKES WEBER said that he thought the case might be one of an early form of acrodermatitis chronica atrophicans (Herxheimer). This condition need not be confined to the ends of limbs, as was well illustrated by the cast of a case in the Dermatology Museum at Zürich. The older atrophic pigmented patch in the present case seemed to be progressing, and somewhat resembled the variety known as Pick's érythromélie; it also resembled the so-called senile atrophic patch sometimes present on the back of the hands of persons who had been much exposed to the sun in their ordinary daily work. Both the Herxheimer and the Pick types were now supposed to be allied to—or to be varieties of—sclerodermia.

Sebocystomatosis (Günther) in a Woman aged 22.—A. C. ROXBURGH, M.D., and I. MUENDE, M.B.

Patient, female, aged 22, in good health, complained that two years ago small papules developed on both anterior axillary folds. These were treated by a practitioner as if they were warts, by cauterization. Since then she has developed similar papules along the sides of the trunk, particularly on the front of each hip, and a few scattered lesions over the central part of the abdomen. These papules are chiefly skin-coloured but a few are yellowish and some slightly blue in colour. They are about one to two millimetres in diameter, smooth and slightly raised above the skin surface. They appear to be situated beneath hair follicles. To the unaided eye the contents appear to be a yellowish, oily substance.

Histological examination.—There are large dilated cysts, lined by from three to five layers of flattened epithelial cells. These spaces appear in the section to be empty owing to the fact that the fatty substances have been dissolved out during the process of embedding the tissue. Close alongside the lower extremity of the cyst-wall one can see a small, flattened sebaceous gland. There is no evidence of continuity between the cyst and the hair follicles or the overlying epidermis.

These cases appear to be very rare and, according to the literature available, have hitherto been found only in the male sex. The condition has been described by Günther as sebocystomatosis, and also by Pringle as steatocystoma multiplex.

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Discussion.—Dr. I. MUENDE said that four years ago he had seen a case almost identical with this, but it was in a man who had the papules in the axilla and the presternal region. The condition was then found to be very rare; it had, he believed, been first described by Pringle, many years ago, as "steatomatosis multiplex," and it had been worked out in Germany by Günther. It was an affection of the hair follicle, just above the entrance of the gland, which prevented the sebum from reaching the surface. The sebum

was produced and dilated the lower part of the hair follicle, the remnants of the sebaceous gland being squeezed to one side. In the end, when it reached a certain size—that of a pea—it ceased to function. Günther mentioned Pringle's case, and others had been described by Bosellini in Italy and Phillipson in Germany. The cysts contained olein and palmitin; there were very few sebaceous cells.

Dr. J. H. TWISTON DAVIES said this case reminded him of one which he described a year or two ago[1] as "multiple horny cysts of the sweat-ducts." There was nothing to indicate the contents of the cyst in the present case, but close by the cyst was a sweat-gland and duct, and he thought that in the lowest part of the sweat-duct, near the coil, there was cornification, i.e., the cells stained deeply with eosin. He asked whether the cyst content had been examined. The point of similarity was that the distribution in this case corresponded with the maximum distribution in his own case; but whereas in his own there was intense pigmentation in the surrounding skin, and the cysts showed up white, in the case now shown there was an intense pigmentation localized to the lesions themselves. Would it be possible to see serial sections of this case? His recollection of the description of Pringle's case was that there were large cysts, containing obviously fatty material and dusky-red inflamed areas, and localized to the front of the chest.

Dr. MUENDE said the cysts were lined with three or four layers of cells; if they were sweat-ducts they would not be lined with more than two layers. Further, one could see, on one side of the cyst, remnants of the sebaceous gland. Its contents were olein and palmitin.

? Mycosis Fungoides.—ROBERT KLABER, M.D.

This patient, a "printer," aged 65, has had this eruption for about twelve years. It began without any preceding irritation, as superficial red scaling lesions on the extensor surfaces of his forearms.

The extensor surface of his thighs and the abdomen were next involved, and the condition gradually spread until two years ago practically the whole of the skin had become involved.

The eruption varies in density from a superficial scaly erythema on the face, scalp and hands, to extensive red infiltrated sheets on the trunk and upper limbs, which cause much irritation.

A few small warty growths are to be seen on the left side of the chest, and the inner aspect of the thighs.

Large, soft, discrete glands are present in both groins and both axillæ. Neither spleen nor liver is palpable. Patient's general health and spirits remain good.

Wassermann and Mantoux reactions both negative. Repeated differential blood-counts, normal.

Biopsy (from an infiltrated area) shows a non-specific inflammatory picture, the infiltrate consisting only of lymphocytes and histiocytes, with some eosinophils, but without the typical features of mycosis fungoides.

Treatment.—The infiltrated lesions responded well to X-ray treatment when ¾ B doses were employed, but they have sooner or later relapsed. The patient has had during the last two years a total dosage of ½—2 B to most of the affected areas, but has had no such treatment during the last two months.

Dr. A. C. ROXBURGH said that he had always regarded this case as one of mycosis fungoides, but the lesions were not so radio-sensitive as one would expect, and the histology of the case was not typical; indeed, he wondered how often the histology of mycosis fungoides was typical. Most of the cases shown before the Section seemed to be exhibited with the comment that they were atypical.

Mycosis Fungoides.—Sir ERNEST GRAHAM-LITTLE, M.D.

The patient is a man, aged about 45, whom I saw for the first time on December 13 last. He then had patches fairly symmetrically distributed of a dry

[1] *Brit. Journ. Derm.*, 1930, xlii 437-442.

moderately scaly eruption, distributed principally upon the trunk, which had begun for the first time in September, 1932. I considered the possibility of an early mycosis fungoides, but the patches did not seem to be sufficiently infiltrated at that time to warrant the diagnosis, and I regarded the condition as probably a parapsoriasis.

I obtained a section of the skin and saw the patient three weeks later, when infiltration had become greatly increased and there was general glandular enlargement. The section, on the whole, supported the diagnosis of mycosis fungoides, which I fear is the correct one. The rapidity of onset and development is remarkable, and of course of grave prognosis.

In Doctor Klaber's case the condition is much more advanced and of much longer duration, but I think both are cases of the same disease.

Intra-epidermal Carcinoma. ? Paget's Disease of the Nipple.—GODFREY BAMBER, M.D.

Mrs. F. G., aged 61.

History.—The lesion began nine years ago, as a red patch around the left nipple. The area increased in size and one year ago became moist. It was treated by exposure to ultra-violet light.

When seen by me one month ago there was a fairly sharply defined pigmented area around the left nipple about 4½ in. in diameter. The epidermis was in places slightly scaly, in others atrophic.

No swelling felt in the breast; no enlarged glands in the axilla.

Biopsy from the edge of the lesion shows some thinning of the epidermis with absence of most of the interpapillary plugs. In the epidermis the greatest departure from normal is seen in the basal layer where the majority of the cells show vacuolation. In the rete are large spaces not bridged by fibrils. A round-celled infiltration confined to the uppermost part of the corium.

Dr. GOLDSMITH said that the clinical appearance was not characteristic of Paget's disease, being more than usually superficial and lacking the smooth, bright red appearance. But histologically, he thought, the predominant large cells were Paget's cells; in any case, the lesion an intra-epidermal carcinoma. One could not be certain of the diagnosis of Paget's disease without making other sections specially stained to define the prickles, as the Paget cell is characterized by its complete retraction from the surrounding rete. If these cells are derived and imported from the special epithelium of the milk-ducts, it might be possible to maintain Paget's disease as a histological entity. But if the Paget cells are autochthonous and derived, by anaplasia, from surface epidermal cells, there are sure to be numberless intermediate types connecting up Paget's disease with Bowen's disease and other forms of intra-epidermal carcinoma. Anyhow, in the Paget type the ducts are generally involved at the same time as the skin and therefore amputation of the breast would probably be the right course.

POSTSCRIPT.—After amputation the whole breast was sent for examination to Sir Lenthal Cheatle who writes: "There is certainly carcinoma in one or two ducts. The disease evidently penetrates deeply into the breast."

? Granuloma Annulare.—W. N. GOLDSMITH, M.D. (for Dr. A. M. H. GRAY).

Patient, female, aged 27. I saw this patient first in the summer of 1932 when Dr. Gray was away. She then had lesions in both axillæ and a few on the abdomen which I thought characteristic of granuloma annulare. Soon after Dr. Gray saw her and agreed with the diagnosis, and later, a biopsy was made which both of us thought confirmed it. Deep in the cutis are several areas of hyaline or necrotic tissue, invaded by various inflammatory cells. The histology has no resemblance to that of sarcoid with which the lesion might be confounded clinically. The

remarkable features are the extent, the unusual distribution, the fact that some of the lesions became slightly ulcerated and healed with what looked like scarring, and the further fact that the axillary lesions were not influenced by X-rays. Actually one would expect that the deep necrosis in the corium, which is a characteristic feature of the histology of granuloma annulare, would always lead to scarring, but, in fact, it is exceedingly rare for it to do so.

Discussion.—Dr. KLABER asked what was thought of the presence of giant-cells in the section from this case and whether they commonly occurred in granuloma annulare. Did not their presence, in this case, support the view that such lesions might, at least sometimes, be of tuberculous origin?

Dr. GOLDSMITH (in reply) said he agreed that there were areas of hyaline change in the connective tissue. He thought it was an early necrotic change, and interpreted it as in favour of granuloma annulare. He did not know how often giant-cells occurred, and did not regard their presence as strong evidence of a tuberculous origin. Where there was a necrotic focus it was common to find giant-cells, which were really foreign-body giant-cells, the foreign body being the necrotic tissue. These cells were indistinguishable from those of the tuberculous type.

Urticaria Pigmentosa.—Sir ERNEST GRAHAM-LITTLE, M.D.

Patient, a man aged about 50, seen quite recently, says that the condition dates from before the late war. A section from one of the lesions shows an absence of mast-cells, but I think the diagnosis of urticaria pigmentosa must be considered on clinical evidence, and the case is one of those rare examples in which mast-cells are not notably numerous.

Section of Neurology.

President—J. S. Risien Russell, M.D.

Clinical Meeting held at the National Hospital, Queen Square, W.C. 1, on February 16, 1933.

Acute Benign Myelitis (Encephalo-myelitis).—J. P. Martin, M.D.

G. G., female, aged 19, was admitted to hospital on November 10, 1932. She had been well until two weeks previously, when she began to vomit and had pain in her chest at about the level of the nipples. The vomiting continued—she "could not keep anything down"—and the pain in the chest gradually became worse. A few days before her admission headache came on. On the morning of November 10, 1932, her legs felt weak, and during that day she had a convulsion, became comatose, and was admitted in an unconscious condition to hospital. Later in the day she recovered consciousness, and she then complained of severe pain in the back and of being unable to see. At that time she was able to draw her legs up in bed. The knee-jerks and ankle-jerks were brisk, the plantar reflexes were indefinite, the upper abdominal reflexes were absent, but the lower were still present. No loss of sensation was noticed on the lower limbs. The evening temperature was 100·6° F.; pulse-rate 88. The patient remained in an apathetic state. She recovered her sight in the course of the morning of November 11, but vomiting continued for another three days and was very severe. Headache also persisted for several days. Within twenty-four hours or so after admission paralysis became complete below the level of the nipples and all the reflexes below that level were lost. Appreciation of pain and temperature was completely lost below the same level. Sense of position was almost completely lost, but touch could be felt everywhere. There was retention of urine at first, then complete incontinence, and incontinence of fæces also. Above the level of the nipples there were no abnormal signs, except that the right pupil was somewhat greater than the left, and the tendon reflexes in the left arm were weak.

The cerebrospinal fluid contained 220 cells, of which 48% were polymorphonuclears and the remainder lymphocytes.

Five days after her admission (15.11.32) the patient was much clearer mentally: she could make a little movement at the right ankle and some movement of rotation of both lower limbs. The sensory condition remained unchanged. The temperature was normal. On November 17, 1932, the cerebrospinal fluid contained 73 cells of which 18% were polymorphonuclears; the protein content was 0·09%. Nonne-Apelt reaction negative. No organisms were detected in the fluid.

The condition has steadily improved. Voluntary movements can now be made at all joints in the right leg; flexion at the hip is one of the weaker movements, but is of sufficient power to raise the foot from the bed when the limb is extended. The movements of the left leg are generally a little weaker than those of the right, and power of dorsiflexion at the left ankle is still absent. The knee-jerks are present, the ankle-jerks absent; the right plantar reflex gives a doubtful feeble extensor response, the left is absent. Touch can be felt everywhere; position of the toes is imperfectly appreciated; painful stimuli are appreciated in the distribution of all segments below L 3 (inclusive) on the right leg; they are not quite perfectly appreciated in the distribution of L 3, 4 and 5 on the left leg, but fully in the distribution of the sacral segments. Bladder action is reflex, and fair control can now be exerted over it. Control of the rectum is normal. On the trunk appreciation of pain stimuli is returning; the impairment is most pronounced in the distribution of segments D 6 to D 10 on both sides, and is generally less on the left than on the right. Cerebrospinal fluid (10.1.33) showed 6 white cells, all lymphocytes; the total protein was 0·06%. Culture sterile.

Discussion.—Dr. MARTIN said that this case had appeared at first to be encephalomyelitis with a large number of polymorphonuclears in the cerebrospinal fluid. The patient had made a good recovery, which, he thought, might eventually be complete. He had seen two similar cases, one in a young man aged 21, who, like this girl, had had an illness of an abdominal character, with a great deal of vomiting, lasting about three weeks, together with considerable temperature, and had then waked up one morning to find that his lower limbs were completely paralysed, and that he had retention of urine. He was admitted to hospital and in about six months, much to his (the speaker's) surprise, he had made a complete recovery. One other patient, under observation at present in hospital, was a man aged about 55, with paralysis affecting chiefly the lower lumbar and sacral segments, with retention of urine. He had been in hospital for about four months, and was improving steadily. Like the girl in the present case, he still had some bladder trouble, but he was able to walk again, and was likely to make a complete recovery. He had only found four similar cases in the literature; these were described in the Archives of Neurology a few years ago under the same title as that of his present case. In all four there had been good recoveries. Probably the condition was closely allied to that in certain other cases in which the paralysis more often extended from below upwards.

Dr. C. P. SYMONDS said that he had reported a number of similar cases a few years ago to the Association of Physicians. One found cases which were intermediate between this type of condition and polyneuritis. He remembered one in a woman who had a week's fever with severe illness, but no physical signs could be found until she began to complain of tingling in the perineum. Knee- and ankle-jerks were absent, and she later had Jacksonian attacks. What interested him about Dr. Martin's case was that there were polymorphonuclear cells in the cerebrospinal fluid. These had certainly not been present in his, the speaker's, own cases.

Dr. MARTIN (in reply to a member) said that the chlorides in the cerebrospinal fluid were normal. Dr. Symonds' cases corresponded closely with some of his (Dr. Martin's) own. He had had certain others in which there was lymphocytosis in the fluid. The present case differed from these in that the incidence was so much more on the cord.

Acute Myelitis.—G. S. HALL, M.B.

I. B., female, aged 34, admitted to hospital January 30, 1933, under the care of Dr. Riddoch, complaining of numbness of the right side of the body below the waist and of loss of power of the left hand, both of two days' duration.

She was well until two weeks ago when she developed a cold and left earache associated with noises; after four days this was succeeded by partial left-sided deafness which lasted three days. She resumed work after two days in bed (one week previous to admission) but noticed continuous pain in back extending downwards from between shoulder-blades and tending to radiate round right side of trunk. Pain disturbed her sleep and was later associated with "terrible knife-like" pains in right side of abdomen; she returned to bed after a few days at work. Pains continued until the morning previous to admission, when she awoke to find them replaced by numbness and a feeling of pins and needles in the right side of the body below the waist. The numbness was associated with weakness of the legs, more marked on the right side. Intermittent aching pain was present in the lower part of the chest "as if the bone would break." For two days she had had weakness of the left hand. She had had retention of urine for one day.

Condition on admission.—Ill-looking Jewess with slight temperature (99·4°). Cranial nerves: normal, apart from a large myopic crescent on the left side and a few nystagmoid movements on full lateral conjugate deviation to either side. Upper limbs: Wrist-drop and paralysis of finger-movements on left side. Slight general weakness and spasticity on left side.

Trunk: Upward deviation of umbilicus on raising head. Lower intercostal muscles not working.

Lower limbs: Slight bilateral spasticity. Complete paralysis of right limb with foot-drop; partial foot-drop on left side with general reduction of motor power.

Reflexes: Brisk in upper limbs; absent in lower limbs, except for preservation of right ankle-jerk. Abdominal reflexes absent; bilateral extensor plantar responses.

Sensation: *Touch, pain, and temperature* lost below level of D 8 anteriorly and at slightly lower level posteriorly; loss is complete except for area of relative loss from L 4 to S 5 on right side. Above anæsthetic area is one of gradually diminishing hypalgesia until normal sensation is reached at D 3. *Vibration* faintly appreciated below waist. Gross position loss in lower and left upper limbs.

Cerebrospinal fluid: Normal pressure readings. Fluid slightly yellow. Cells 104 per c.mm. (85% small monos., 10% polymorphs., 5% large monos.). Total protein 0·175%. Globulin tests positive; Lange 0001222222. Wassermann reaction negative.

Blood: Leucocytosis (18,200) present. Wassermann reaction negative.

Progress.—Paraplegia rapidly became complete with absence of all deep reflexes in lower limbs; extensor plantar responses remained. After four days ankle-jerks returned and sensory loss on right side of body became less marked. Has been doubly incontinent for past two days.

Discussion.—Dr. D. DENNY-BROWN said that this case seemed to bring up the same question of pathology as that in the case just shown by Dr. Martin. The sharp sensory level in disseminated encephalo-myelitis was of interest in that it did not there indicate a focal lesion, and therefore did not seem to be of importance in the differential diagnosis between the focal and disseminated types. In one case of acute myelitis which he had seen the patient had had a prodromal illness lasting a week, during which a crop of herpes occurred on the palms of the hands and soles of the feet. As the herpes disappeared the cord lesion became evident, but not until then. The patient at the time of the occurrence of the group of herpes and for the next forty-eight hours or more had no cord symptoms at all. It had always appeared to him (the speaker) that the herpes was perhaps some significant evidence of the occurrence of a more generalized dissemination than the apparently focal character of the subsequent myelitis would lead one to suppose.

Dr. MACDONALD CRITCHLEY said that a certain number of cases were probably instances of vascular disease of the spinal cord. The acute transverse cord lesions coming on after febrile disorders or during convalescence from influenza might well, in a proportion of cases, be vascular rather than inflammatory. An occlusion of the anterior spinal artery would give a transverse lesion which would be difficult clinically to distinguish from myelitis.

The PRESIDENT said that he was interested to hear thrombosis suggested as the possible cause as, when he was pathologist at Queen Square, Dr. Charlton Bastian always contended that the majority of cases of transverse myelitis were really due to thrombosis.

Dr. C. WORSTER-DROUGHT asked if one would expect lymphocytosis in the cerebrospinal fluid in a purely vascular condition. The account of the symptoms rather suggested an inflammatory state.

Dr. J. P. MARTIN said that in one case seen in hospital the lesion had appeared (post mortem) to be a venous thrombosis, although he had felt quite convinced from the clinical history that the condition was inflammatory. The patient was a young girl, who had pain in the back for forty-eight hours, followed by complete paraplegia, from which she never recovered. The cerebrospinal fluid had a high protein content. Dr. Greenfield had told him that in some other cases which were apparently vascular, lymphocytes and, occasionally, polymorphonuclears, were found in the cerebrospinal fluid. He might mention the case of a woman aged 65, who was out in the street when suddenly her legs became weak, and she had to cling to some railings. She was assisted by passers-by, and when medical attention was called to her it was found that she had a complete flaccid paraplegia; from this she never recovered. This case, he supposed, must be a vascular lesion; the onset seemed far too rapid for any other kind of disease. One had seen also syphilitic cases which had shown a persistent flaccid paraplegia. He was inclined to think that the lesion in such cases was not simply at one level but extended down the cord and was probably due to thrombosis of the anterior spinal artery.

Dr. C. P. SYMONDS said he believed that an acute vascular softening of the spinal cord might also produce a sharp rise in temperature. He wondered if the cases referred to by the Chairman had occurred in young people.

Brushfield-Wyatt Syndrome.—DENIS BRINTON, M.R.C.P.

I. M., female, aged 20, single. Patient has suffered from fits, weakness of the left side of the body, and a mild degree of mental deficiency ever since birth. She has also had a very extensive capillary nævus, chiefly over the right side of the body, but also invading the left, for the same time.

She is now able to read simple words, to count, to knit and do fancy stitching, and to go shopping—managing the changing of money.

On examination she presents: (1) A left hemiplegia of infantile type, with occasional athetoid movements of the left arm; (2) a left hemianopia (homonymous); (3) the port-wine stain as described above.

X-ray examination shows a very extensive calcified venous angioma extending throughout the right cerebral hemisphere, from the frontal to the occipital region.

Commentary.—A number of cases of this syndrome have been described lately, but this present case is a well-developed instance. In order to emphasize this I show pictures from two other cases, one of which corresponded to the type rather more commonly known as "trigeminal" nævus, because the port-wine stain was confined to the trigeminal area. This patient also had a calcified angioma within the skull, as shown by X-rays. The other patient was a man with the "trigeminal" port-wine stain, but no intracranial change was found on X-ray examination. This patient differed from the other two in being extremely intelligent, and no signs of organic nervous disease were elicited. There was, however, this interesting point, that for about twenty years—he was a man aged about 60—he had had attacks of disturbed vision of a migrainous character, and also a different type of attack—a kind of visual aphasia. He had a left-sided nævus, and therefore, arguing from analogy with the other cases, he might be presumed to have a left-sided cerebral lesion of sorts. Is any recent post-mortem account of a case of this type available? The only account that I have found referred back to the end of the last century, when a German authority described the connection of these port-wine stains with a venous angioma. Cushing in his book simply stated that it had occurred. Has a case been described in which some intracranial lesion had been discovered without any calcification making it evident during life? The elderly man whom I am at present watching might presently come to post-mortem examination and give me the opportunity of deciding that point.

Discussion.—Dr. WORSTER-DROUGHT said he wished to criticize the name applied to this class of case. One always approached the question of priority in medicine with some diffidence; but while admiration was due to Dr. Brushfield and Dr. Wyatt for their admirable description of the cases recorded by them, if we were to apply the names of a particular individual to a syndrome, the first to describe the condition might at least be given the credit. As long ago as 1898, Lannois and Bernoud [1], in France, had described a case, while Kalisher [2], in 1901, recorded a further example with a complete account of the post-mortem examination. In 1906, Harvey Cushing [3] in America, had discussed this type of case, and Parkes Weber [4] in this country, in 1922, described the radiographic appearances of the calcified venous angioma. It was not until 1927 and 1928 that Dr. Brushfield and Dr. Wyatt's papers were published [5]. Parkes Weber [6], in a later and more elaborate paper (1928) defined the condition as a "cutaneous and meningeal hæmangiectatic nævus with contralateral hemiplegia." If one desired to shorten this description, "Lannois-Bernoud's Syndrome" would appear more correct.

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Dr. BRINTON (in reply) said he agreed that he had really no defence for the title given to this case. He did object, however, to any suggestion that there was any valid reason for describing the lesion as "trigeminal." The nævus was far outside any trigeminal field, and that might have influenced him rather in calling it the Brushfield-Wyatt syndrome. The condition of the retinæ was perfectly normal, peripherally and centrally.

Progressive Hemiplegia. ? Chronic Subdural Hæmatoma.—S. NEVIN, M.D.

E. C., male, aged 32, admitted to hospital, February 8, 1933, under Dr. Stewart.

History.—Full-time child. Forceps delivery, with some injury to right side of head, resulting in a swelling which subsided in a week. No convulsions. At seven months of age, enlargement of head was noticed. Since then the head has probably always been larger than normal, but recently the mother has noticed that this is increasing and that the right side is slightly larger than the left. The patient is not deficient mentally.

Since the age of 14 he has complained of attacks of twitching of the left side of the face, and clonic movements of left arm and leg, without loss of consciousness, and of progressive stiffness and weakness of left leg with more recent involvement of left arm. Four months ago severe right-sided headache occurred lasting one week.

On examination.—Marked enlargement of skull, slightly greater on right side, with greatest circumference 24½ in. Left-sided hemiparesis with some loss of sense of position and passive movement in left arm and leg and left homonymous hemianopia. Cerebrospinal fluid: Pressure 120; total protein 0·055%; no cells, and otherwise negative. Skiagram shows thickened and enlarged skull.

In a case of verified chronic subdural hæmatoma shown by Dr. Critchley and Dr. Meadows at a previous meeting the history was somewhat similar to that in this case. The enlargement of the head in that case had begun at about the age of four months, and in the present case it probably began at the age of seven months.

Sir JAMES PURVES-STEWART said that it might be advisable, since encephalography had failed to introduce air into the ventricles from below, to adopt the alternative method of putting it in from above. This could be done with a minimum of trauma, using a suitable drill through the skull. If the patient had a large hæmatoma this procedure could be carried out without difficulty.

Progressive Syndrome of Muscular Rigidity and Tonic Involuntary Movements.—J. P. MARTIN, M.D.

L. H., male, aged 15, is said to have been normal till about the age of six years. Then he began to drag his right leg and to be awkward with his right hand. In the course of five or six years all his limbs became more stiff and awkward, but he continued to go about till he was 12. Then he became almost unable to walk alone. During the last two years his head has gradually tended to bend forward and his right hand makes slow involuntary movements which carry it either against his chin or right up over his head to the back of his neck.

Present condition.—The patient sits in a flexed, huddled attitude, with his neck acutely flexed. He is able to raise his head slowly through a moderate range. His mentality is normal and there is no speech defect.

The cranial nerve functions are normal, except that voluntary movements of the face are more restricted than emotional movements.

The right upper limb normally assumes a flexed posture. It can sometimes be extended voluntarily, but it is subject to long-sustained flexion spasms. These often come on in association with voluntary movements of the left hand, but are also produced by emotional stimuli. When the hand is extended its posture is markedly athetoid. With the left arm much more voluntary movement can be made and no involuntary movements occur in the left arm, but the posture of the left hand when outstretched is much the same as that of the right.

The right lower limb is subject to slow flexor spasms, which are caused by similar stimuli to those which bring on spasms in the right arm and the spasms in the two limbs of the right side often occur together.

In all the limbs there is great resistance to passive movements, both flexor and extensor, but there is some tendency for the resistance to give way in a "clasp-knife" manner. The tendon-jerks are all brisk. The great toes are constantly in an extended position. Stimulation of the sole often gives rise to a slow movement which involves further extension of the great toe, but this movement is sustained and is probably part of a tonic athetoid movement and not a Babinski reflex.

Discussion.—Dr. MARTIN said he was inclined to think that the symptoms were entirely extra-pyramidal; there were no definitely pyramidal signs. Under favourable circumstances one was able to get a flexor-plantar response which for the time being overcame the spasm. Undoubtedly in the upper limbs the rigidity was rather like true spasticity, but having watched the boy for a long time, and having seen the variations of this rigidity, he thought that it was more allied to the Parkinsonian type of rigidity. The involuntary movements were all slow and long sustained. One of the most characteristic was the flexor spasm of the right arm. The boy's head that evening was in the position of extension, but when he (the speaker) saw him previously his head was fixed in flexion. At an earlier stage the right hand used to make movements which carried it up over the head. These movements might be brought on by emotional stimuli, and then he would have a flexor spasm not only of his arm, but also of his right leg—and again the same slow type of movement. With regard to the title which should be given to the case, he was a little at a loss. This was evidently a progressive disease, and as regards its underlying pathology, he had an entirely open mind. He supposed it was due to some form of degeneration in the basal nuclei; further than that he did not like to go.

Sir JAMES PURVES-STEWART said that the fact that a person had a striatal syndrome did not necessarily mean that this was a stationary affair; it might be an advancing syndrome. Only a fortnight ago he saw, with Dr. Collier, two young Spaniards in the same family who were developing symptoms of typical torsion-spasm. In one, a boy, the condition had begun at the age of 6 and he was now aged 12; in the other, a man, it had begun at the age of 15 and he was now aged 30. The symptoms were progressively developing from month to month and year to year. The serological and hæmatological analyses were negative. He suggested that many such cases were really due to a slowly progressive encephalitis, of infective or toxic origin.

Dr. C. P. SYMONDS said that in these progressive striatal syndromes almost every case differed from every other; he supposed that it depended on the chance of localization. The most nearly similar case to the present one which he could recollect was like that just mentioned by Sir James Purves-Stewart. Two brothers had something like the same syndrome, but there was more mobile spasm and less tonic spasm than in Dr. Martin's case. As to the labelling of these cases, there was so much variation among them that he was reminded of Sir Henry Head's statement with regard to these familial conditions, to the effect that there was "no such disease," but that each family had its own variation.

Dr. MARTIN (in reply) said that inquiry had been made as to a possible history of encephalitis lethargica, but none had been discovered. The cases referred to in the Archives were mostly in infants. He had been very careful not to make any assumption as to pathology in this case, because he thought that with regard to these extra-pyramidal syndromes, they were at present merely at the stage of collecting facts; they did not know enough to correlate their knowledge in any fixed way.

Dystrophia Myotonica.—J. E. CAUGHEY, M.B.

J. de N., female, aged 53, unmarried. Admitted to hospital under the care of Dr. Adie.

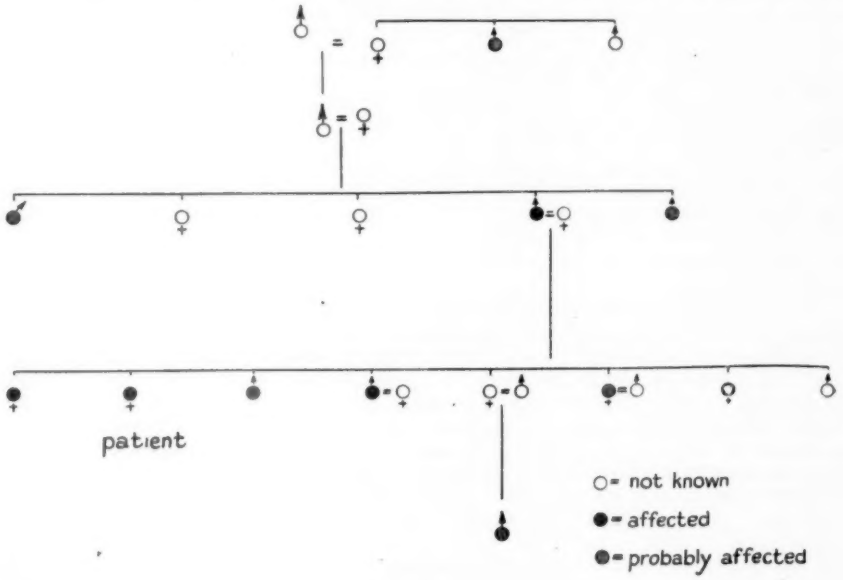
History.—Patient was well until the age of 25 when she complained of weakness of the neck muscles. Four years later the weakness had become more generalized and there was difficulty in rising from the sitting and horizontal postures. This weakness has gradually increased and for the last five years she has been confined

to the house and is only able to move about with difficulty. Since the age of 35 there has been a marked tendency to fall unexpectedly.

Condition on examination.—Myopathic facies with bilateral ptosis and marked weakness of orbiculares oculorum. Smiling weak and smile lingers longer than is usual. Speech slurred and slightly nasal. Wasting of temporal muscles; weakness of jaw closure. Forward flexion of head and complete wasting of sternomastoids. In the arms, wasting of the small muscles of the hands, and of flexor and extensor muscles of the forearms. Weakness in all muscle groups. In the lower limbs, wasting of the anterior tibial muscles. Generalized weakness of all muscle groups, especially of the dorsiflexors of the feet.

Active myotonia present in the flexors of the fingers. Mechanical myotonia present in the tongue, and in the muscles of the thenar and hypothenar eminences.

Diminution of all deep reflexes, with complete absence of knee- and ankle-jerks.



Bilateral lenticular opacities; frontal baldness.

Electrical reactions: Partial reaction of degeneration of muscles of face, arms and legs.

Family history.—Patient's great-grandmother was a princess of the royal family of Greece; of her brother we read in a historical document—"short, bald, speaking through his nose, looking forty at the age of twenty-five." The grandfather, an only child, had five children. Of these, two had dystrophia myotonica. Patient's father was one of the two affected. He had eight children, five of whom have the fully developed disease. A nephew, the only member of the new generation, has wasting of the deep muscles of the neck; his age is 13.

Dystrophia Myotonica.—S. P. MEADOWS, M.D.

E. C., male, aged 50, unmarried. A patient of Dr. Macdonald Critchley.

History.—In 1918, when aged 35, found that his knees began to give way when walking, and had difficulty in getting up from the sitting posture.

About same time also noticed weakness of grip of both hands and difficulty in relaxing grasp.

He thinks that the wasting of his legs and forearms appeared in 1918, and at first affected the legs more severely than the arms. The wasting and weakness have slowly progressed.

Since onset of complaint in 1918, has had occasional aching pains in calves and thighs. His hair began to fall and he noticed that his sight was impaired slightly at the onset of the other symptoms. His voice has become indistinct, and he has occasional difficulty in swallowing. Fluids regurgitate through his nose at times. He thinks his neck has always been weak, but that it was especially so since an operation for torticollis in 1898.

Past illnesses.—Scarlet fever at age of 12. Pleurisy and pulmonary tuberculosis at age of 20. Since the age of 6, his head has been tilted to the right side. In 1898, at the age of 15, he was operated on for torticollis and the right sternomastoid was cut.

Family history.—One brother and two sisters, all dead. Brother died aged 2 (? bronchitis); one sister died from diphtheria, aged 19; eldest sister died from chronic pulmonary tuberculosis two years ago. Father died aged 68 from heart disease. Mother died at the age of 64 from heart failure following bronchitis.

Father had one quite blind eye, and had a cataract removed from the other eye. The cataract developed when he was aged about 50. Mother had bilateral cataract, which developed at about the age of 50. Had operation performed for cataract. One paternal aunt, still living, has a cataract.

Patient does not know of any other case in his family with a similar condition to his own.

Examination.—A tall, thin, gaunt-looking man, with frontal baldness. Myopathic facies, with bilateral ptosis and compensatory contraction of frontalis. Temporal muscles somewhat wasted. Neck: Long and thin; marked wasting of deep muscles; right sternomastoid completely wasted; left sternomastoid represented by thin band of muscle. Speech: Indistinct and slurring, with nasal character in voice. Upper limbs: Marked wasting and weakness of anterior and posterior forearm muscles; moderate wasting of interossei and thenar and hypothenar eminences; muscles of upper arms slightly wasted. No fibrillation. Myotonic hand grasp. Lower limbs: Marked wasting and weakness of vasti, quadriceps, calf muscles and anterior tibial muscles. No fibrillation. Bilateral foot-drop. Reflexes: Arm-jerks sluggish; abdominals present; knee and ankle jerks absent. Plantar responses flexor. Testes: Small and soft. Testicular sensation normal. Skin: Pigmented over chest and abdomen. Axillæ and areolæ markedly pigmented. Cataract: Commencing triradiate opacity, situated posteriorly in left lens. Pupils: Right slightly irregular; rather sluggish reaction, through a small range to light in both eyes. Bilateral facial weakness. Tongue fissured. Slight mechanical myotonia occasionally seen. Larynx.—Cords do not completely approximate on phonation. Gait: Wide base, "steppage." Trunk held flexed at hips. His neck droops forward and is extended in the upper cervical region in a swan-like fashion. Chest: Signs of fibrosis left upper chest. Blood-pressure: 120/80.

Electrical reactions of right forearm muscles show partial reaction of degeneration. Complete R.D. of tibialis anticus.

Cerebrospinal fluid normal.

Blood-count: R.B.C. (4,500,000); Hb. = 88%; C.I. 0·98; W.B.C. 11,600 (polymorphs. 59%, lymphos. 34%).

Syphilitic Meningo-myelitis with Muscular Wasting ("Syphilitic Amyotrophy").—E. GRAEME ROBERTSON, M.D.

L. N., female, aged 31, admitted to hospital under the care of Dr. Carmichael, January 26, 1933.

Four years ago she became aware of an intermittent sensation of tingling over the tips of the fingers of her left hand. Three weeks later when she attempted to lift a heavy object she dropped it and the weakness increased until three months later she noticed aching followed by weakness of the wrist. Her hand was blue and cold and all the symptoms were worse in cold weather. Three years ago she commenced to feel pains over the left cervical region, and a burning sensation over the spines of the sixth and seventh cervical vertebræ.

During the last two months she has experienced frontal or parietal headaches of varying duration—the longest lasting for a week and being associated with a considerable degree of mental confusion.

She has been married for eight years and has never been pregnant.

Examination reveals the following physical signs: Left-sided cervical sympathetic palsy; slight diminution of sensation over the left side of the face; protrusion of tongue to the left; left claw hand with marked wasting of all the intrinsic muscles, and of the flexor-pronator group in the forearm; slight wasting of the muscles of the upper arm; tendon reflexes in the arms brisk, especially on the left side; superficial abdominal reflexes present; knee-jerks equal and active; slight spasticity of the calf muscles with increased ankle-jerks and extensor plantars; marked thickening of the subcutaneous tissue around the ankles, with proliferation of synovial membrane, causing loculated bursæ, under the blue and discoloured skin.

The cerebrospinal fluid pressure readings were normal. The fluid was clear and colourless, containing twenty-four cells per c.mm. (85% lymphocytes, 5% large mononuclears, 10% polymorphs). Total protein 0·040% Nonne-Apelt and Pandy tests negative. Lange 0112221100. Wassermann reaction: positive in the cerebrospinal fluid, 4443, and in the blood, 4444.

Discussion.—Dr. E. GRAEME ROBERTSON said that the controversy as to the nosology and pathology of these cases had lately been more or less resolved. Clinically, there were two points of interest. (1) Most of the cases described had been atonic, with absent reflexes and wasted limbs. The patient in this case showed exaggerated reflexes. (2) The persistent headache for two months before admission, which suggested the diagnosis clinically, and was explained by the meningeal reaction of the cerebrospinal fluid.

Dr. C. WORSTER-DROUGHT asked what had been the experience of members regarding the ultimate outlook in these cases. He had had the opportunity of watching several similar cases over a number of years, and, far from responding to anti-syphilitic treatment as was generally supposed, they had gone downhill steadily although less rapidly than ordinary "motor neurone degeneration."

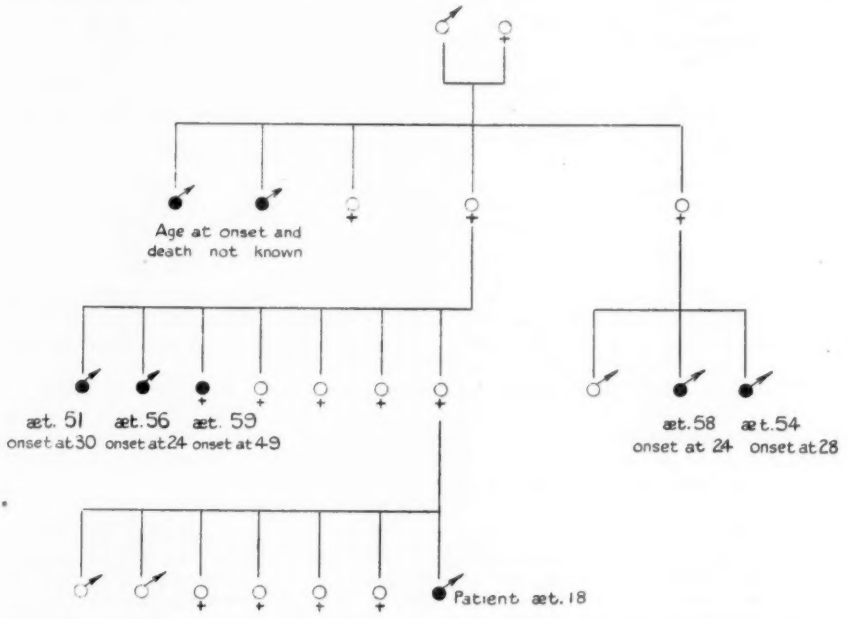
Dr. J. P. MARTIN said that he had described in a paper the results of treatment in six cases. Two or three of them were taken relatively early and seemed to respond well to treatment, but in the others the treatment had apparently not much effect; it might have slowed down the process a little, but it had not arrested it. In looking through the literature he had found the same variability in the results described. He sympathized with Dr. Carmichael with regard to the difficulty of diagnosis in this case.

Dr. C. P. SYMONDS, with regard to the difficulty in differential diagnosis from syringomyelia, suggested that the point of greatest differential importance was the absence in syringomyelia of the arm reflexes.

Leber's Disease.—S. NEVIN, M.D.

W. B., male, aged 18, admitted to hospital June 21, 1932, under Dr. Adie.

History.—Patient was well until eight months previous to admission, when blurring of vision occurred in the right eye. Five weeks afterwards central vision in this eye was absent. Four and a half months after the onset of blurring of vision in his right eye, the left eye became affected and slowly grew worse, and on admission he could only read the largest print letter by letter. No other symptoms.


Age at onset and death not known
æt. 51 onset at 30
æt. 56 onset at 24
æt. 59 onset at 49
æt. 58 onset at 24
æt. 54 onset at 28
Patient æt. 18

On examination.—Central vision in both eyes absent, due to central scotoma, larger in right eye. General impairment of peripheral vision. Some colour-vision remaining for red and green only in lower temporal fields of both eyes. Discs hyperæmic with blurring of edges and slight temporal pallor in both eyes.

Family history, as far as known, shows that on the female side, two uncles and one aunt, two grand-uncles and two sons of a grand-aunt have been affected with the disease.

Section of Radiology.

President—RUSSELL J. REYNOLDS, C.B.E., M.B.

[*March* 17, 1933.]

Pathological Calcification and Ossification in Relation to Leriche and Policard's Theory.

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ABSTRACT. (1) *Pathology of calcification and ossification.*—The Leriche-Policard theories. Hyperæmia of bone causes decalcification. Reduced blood supply causes sclerosis. Diminution of vascularity of fibrous tissue causes calcification. Excess of calcium, adequate blood supply and fibroblasts give rise to bone anywhere.

Subperiosteal ossification. "Myositis ossificans."

(2) *Radiological significance of density of bone shadows.*—Decalcification of disuse, of infections, of neoplasms. Traumatic and infective sequestra. Evidence that a fragment of bone is avascular.

(3) *Hyperæmic decalcification of bone.*—Delayed and non-union of fractures. Kummel's disease. Spontaneous hyperæmic dislocation of the atlas. Hyperæmic decalcification and nephrolithiasis.

(4) *Anæmic sclerosis of bone.* — Syphilitic bone disease. Malignant bone disease. Fragility of sclerosed bone — Paget's, Kienboch's, Kohler's and Panner's, Albers-Schönberg's diseases.

(5) *Pathological calcification.*—Calcification of supraspinatus tendon. Calcification of tumours—angioma, hæmatoma, and thrombosed vessels, lipoma, cysts, etc. Calcification of semilunar cartilages and intervertebral discs.

(6) *Pathological ossification.*—Ossification of tendons. Ossification of semilunar cartilages.

FOR many years radiologists have been familiar with the "atrophic bone changes" seen as a sequel to trauma or in the presence of infection. They have noted increased density or sclerosis of the bones in syphilitic periostitis, chronic osteitis, Paget's disease, and other lesions. They have frequently recorded cases of calcification in various sites in the soft tissues, and they have recognized the presence of ossification in subperiosteal hæmatomata and tendinous attachments.

Similarly, pathologists have often reported cases of calcification and ossification in various tissues, and they have for many years recognized that there exists a relationship between blood supply and calcification.

In 1911 Wells went so far as to deduce that "in order to have ossification of calcified deposits, certain conditions of relationship between calcium salts, fibrous tissue, and blood supply evidently must be exactly met."

In 1926 Leriche and Policard advanced a step further, and enunciated theories by which they claim satisfactorily to explain decalcification, calcification and ossification of all types.

THE THEORIES OF LERICHE AND POLICARD.

(*a*) They base their theories on the accepted view that the early undifferentiated mesenchyme of the embryo forms a common mesoblastic stem from which may develop either fibrous tissue, or cartilage, or bone, and that these tissues can only be converted into each other by a preliminary reversion to this undifferentiated tissue. They also hold that the bone-cell of Purkinje is merely a fibroblast which is imprisoned in the bone, and is in a state of quiescence; that the osteoblast is a fibroblast, enlarged because it is active, but possessing no specific power of bone formation; whilst the osteoclast is merely a foreign-body giant-cell.

The important function of the bone-cells is the absorption and mobilization of calcium, the process known as "halisteresis." This function is stimulated and accelerated by an increase in the arterial blood supply, and is reduced or suspended by a reduction in the blood supply.

(*b*) According to their view there exists a definite relationship between vascularity and calcification of bone. They maintain that if the blood supply to the bone is increased, decalcification takes place, and that if it be diminished, the bone undergoes sclerosis. The hyperæmia may be caused by trauma or infection, or it may be of the nature of a "relative" hyperæmia from disuse, the blood supply to the bone in such a case being in excess of the functional requirements of the part.

If, as in the case of a sequestrum or of a completely dislocated bone with severance of its nutrient vessels, the blood supply is completely shut off, no change in the calcium content of this bony fragment takes place.

(*c*) Deposition of calcium in connective tissues of low metabolism may take place if the blood supply to these tissues is diminished. It is therefore seen most commonly in such tissues when they have previously been the site of trauma, infection, or degeneration. In such cases, however, calcification is not inevitable, so that an added hypercalcæmia, possibly transient, may have to be presumed before such pathological calcifications can take place.

(*d*) In the presence of fibroblasts the only requirements for the development of bone are (1) an adequate local blood supply, and (2) an excess of calcium. If these two requirements are fulfilled any adult tissue which can be de-differentiated into primitive mesenchyme may be built up again as bone. It follows also that pathological calcareous deposits in any region of the body may change into pathological ossific deposits. So long as the ischæmia which has caused the calcium deposit persists, the latter will remain a non-living mass of amorphous calcium carbonate and phosphate. But if an adequate hyperæmia supervenes (whether it be irritative, traumatic, infective, or operative in origin) the factors requisite for "new bone formation" are all present. The occurrence of "heterotopic" and other ossifications is thus readily explained.

CONSIDERATION OF THESE THEORIES IN RELATION TO RADIOLOGY AND PATHOLOGY.

(*a*) *Hyperæmic decalcification.*—That bony decalcification takes place in the neighbourhood of a fracture or of a joint affected by tuberculous or pyogenic infection, giving rise to the radiographic appearances of "bone atrophy," is sufficiently well recognized to need no amplification.

In cases of whitlow, the degree of decalcification may be so marked that it is mistaken radiographically for extensive necrosis, though subsequent regeneration proves most of the translucency to have been merely the result of decalcification and not of destruction.

Puzzling cases are occasionally encountered in which the head of the femur or of the humerus appears to have been completely destroyed, yet the bones retain their normal position and subsequently "regenerate." These may now be regarded as

cases of extensive hyperæmic decalcification due to joint infection in which little or no bony destruction has actually taken place.

Kummel's disease of the spine (in which collapse of a vertebral body takes place weeks or months after an injury, though immediately after the injury it is stated that no fracture is demonstrable) may again be satisfactorily explained on the basis of traumatic hyperæmic decalcification.

A type of hyperæmic decalcification which is of great importance is that which sometimes affects the atlas in inflammatory or other lesions of the tonsils, pharynx, or cervical glands. Several such cases have been described where the hyperæmic decalcification has been so marked that the transverse ligament has become detached and dislocation has ensued, sometimes with fatal results.

Cases of regeneration of apparently extensively destroyed bone in the vicinity of sarcomata have been observed. It is recognized that these growths have the power of inciting vascularization of the neighbouring tissues. The apparent destruction of the neighbouring bone can therefore be attributed to hyperæmic decalcification.

In one such case, treated with X-rays and colloidal lead, obliteration of these new vessels occurred so that the greater part of the bone involved (scapula) regenerated. Decalcification recurred when treatment was stopped, but reorganization again took place when further treatment was given.

It is important, therefore, to realize that the bones in the vicinity of a trauma, infection, or sarcoma may become markedly decalcified as a result of hyperæmia, and that this intense decalcification must not be mistaken for destruction.

Furthermore, the degree of traumatic hyperæmic decalcification varies with the degree of disuse resulting from treatment. If a Colles fracture be put up in long splints which, in addition to immobilizing the bony fragments, also interferes with the use of the neighbouring parts, the degree of hyperæmic decalcification will be greater than if the fragments are immobilized (just as completely) by means of a plaster cast which leaves free the fingers and palm of the hand. In the latter case there is less "disuse" than in the former, with less relative or functional hyperæmia, and therefore less hyperæmic decalcification.

In cases of injury it is sometimes seen in the radiograph that one fragment looks dense in comparison with the neighbouring bony parts. Actually this density is merely relative—this fragment is of normal density, but "stands out" in the picture on account of the surrounding hyperæmic decalcification. In such a case all that has happened is that the blood supply to it has been completely shut off, i.e., it is now avascular. This is well illustrated in the sequestrum of osteomyelitis, but is not so generally recognized in carpal and tarsal injuries. A fracture at the waist of the carpal scaphoid, or in the neck of the astragalus with dislocation of the proximal fragment, will sometimes result in complete cutting off of the blood supply of the latter. As a result it will retain its normal calcium content without being involved in the process of hyperæmic decalcification which is seen in the surrounding bones. In the case of a backward displacement of the lower radial epiphysis, even though complete reduction has been effected, one can surmise the nature of the injury from the accompanying tearing off of the chip from the posterior surface of the metaphysis. Just as certainly can one diagnose an injury such as has been described in the astragalus or carpal scaphoid, even though reduction has been effected, by the difference in density between this bony fragment and its neighbours.

(*b*) *Pathological calcification.*—It is beyond the scope of this paper to describe the multitudinous instances of pathological calcification with which the radiologist is familiar. Their occurrence is invariably in tissues derived from the common mesoblastic stem, i.e., bone, cartilage or fibrous tissue. Furthermore, a mental review of such cases will readily confirm the contention of Leriche and Policard that such calcifications only take place as the result of a diminished blood supply,

in a tissue which is either normally of low metabolism, or whose metabolism has been lowered by a preceding trauma, infection or degeneration.

Calcifications may therefore be observed ;—

(1) In intervertebral discs and semilunar cartilages.
(2) In old tuberculous foci and old abscess cavities, in which the original hyperæmia has subsided.
(3) In the walls of parasitic cysts.
(4) In tendons such as the supraspinatus and tendo Achillis.
(5) In the dura mater and falx cerebri.
(6) In the walls of arteriosclerotic arteries.
(7) In the heart after fibrous myocarditis and in the pericardium following adhesive pericarditis.
(8) In the subcutaneous tissues in Raynaud's disease.
(9) In the thrombi of phleboliths and hæmangiomata.
(10) In simple tumours such as degenerating fibromata and lipomata.

It is obvious, however, that calcification is not the inevitable sequel of fibrosis of an avascular connective tissue, or pathological calcification would be much more common than it actually is. It is possible that the local factors of fibrosis and diminished blood supply must be combined with the general factor of a transient hypercalcæmia.

It should be observed that while ossification denotes life and strength, calcification in bones denotes diminished vitality and weakness. As an instance of this might be quoted the well-known fragility of the bones in the early or calcifying stage of Paget's disease as compared with their comparative strength after re-ossification by well-defined trabeculæ ; similarly in Albers-Schönberg's disease (" marble bone ") the bone is extremely dense, yet it is fragile. Under the same heading of dense but fragile bone would come the deformity of the carpal semilunar in Kienboch's disease, and of the tarsal scaphoid in Köhler's disease.

(*c*) *Pathological ossification.*—According to the theory of Leriche and Policard, in the presence of fibroblasts only two requirements need to be fulfilled to bring about the formation of bone, viz., (1) a plentiful supply of calcium, and (2) an adequate blood supply. Provided that there is an excess of calcium and an adequate local blood supply, any mass of undifferentiated mesenchyme may therefore become ossified.

The common sites of calcification are also, therefore, the sites of heterotopic bone formation. This fact has long been known to pathologists, who frequently find microscopical evidence of true bone formation in the examination of specimens of pathological calcification.

Before heterotopic bone of this type can be formed, however, the tissues involved must revert to undifferentiated mesenchyme, and the ischæmia causing the calcification must, to some extent, give place to a hyperæmia. The latter is brought about under the irritative effects of the calcareous granules, which act as foreign bodies and incite a local hyperæmia. As there is a local excess of calcium readily available it is then but a short step to ossification of the previously calcified area. The ossification of rib cartilages and of fibrous tissue generally is thus readily explained.

In Paget's disease the whole series of changes may be seen to be taking place more or less simultaneously—the de-differentation of bone into primitive mesenchyme, the deposit of calcium, and the final formation of strands or trabeculæ of new bone.

In subperiosteal hæmatomata which, in addition to elevating the periosteum, may have penetrated it in places, there is obviously a huge store of calcium readily available, so that it is not surprising that such lesions frequently ossify, giving rise to the so-called " traumatic osteoma."

Similar ossifications may take place in the region of joints, especially the elbow; these have erroneously been designated "traumatic myositis ossificans." The new bone formed in such lesions, however, is due to ossification under the forcibly elevated periosteum at the muscular or tendinous attachments.

That the local store of calcium plays an important part in the promotion of ossification was recognized as long ago as 1895. In this year Barth carried out a series of experiments in which he implanted into bony defects pieces of living bone, dead bone, bone ash, calcium sulphate, and in all these cases obtained ossification. When, however, he implanted decalcified bone no ossification took place.

Conclusions.

A consideration of the radiological and pathological evidence concerning decalcification, calcification and ossification leads one to the conclusion that Leriche and Policard's theories are in substance sound. It still remains to be shown, however, what factors are involved in deciding whether a connective tissue which has had its metabolism lowered and its blood supply reduced shall, or shall not, become the site of calcification. As this does not by any means invariably happen in such tissues, there must obviously be other factors which influence their calcification or otherwise.

Similarly, in ossification there must obviously be factors which control the degree of hyperæmia. If the optimum degree be not reached bone will not be formed; if it be exceeded bone may be formed, but it will be decalcified again.

The theories of Leriche and Policard must obviously be correlated with various biochemical problems—such as the action of phosphatase, of the endocrine glands and of vitamin D, the hydrogen-ion concentration of the blood, the respective parts played by the calcium and the phosphate-ion and so on.

As far as they go, however, the theories of Leriche and Policard appear to provide a reasonable solution of many or most of the problems of calcification and ossification encountered in radiological practice.

Discussion.—The President said, with reference to the statement of Mr. Watson Jones that renal calculi were common in patients who were compelled to lie up for a long time, whatever the cause of such lying-in may have been, he (the President) had had several such cases himself.

With regard to calcification of bone following the use of X-rays, after injections of metals, such as lead, he had found that this took place without lead or other injection, simply following ordinary deep X-ray treatment.

Dr. J. F. Brailsford said that a number of debatable points had been raised and he would like to mention one or two matters which did not quite fit in with the picture. One was injury to the wrist-joint. In some instances of this accident it was found, on examining by X-rays immediately afterwards, that there was not the slightest sign of bone change. He (Dr. Brailsford) had such a case at the present time. A month after the accident, however, X-ray examination revealed the appearance of a definite cyst inside the scaphoid with a fine fissure through it suggesting a fracture and, as in Mr. Watson Jones's pictures, an erosion of bone had occurred on either side of the fracture. That condition was not so easily explained. And with the Kienboch's fracture the first sign seen—and this applied also to Köhler's scaphoid condition and other conditions of osteo-chondritis—was an increased density of the bone; apparently the bone did not show any deformity. Then it gradually crumpled up, and there were islands of condensation in a relatively transparent matrix which, if carefully watched, developed areas of newly laid-down bone, and bone of apparently the same density as the other bone in the vicinity.

Mr. Watson Jones had shown a skiagram of a tibia from a subject of Paget's disease, which he said showed multiple fractures. That appearance had been worked out by Looser, who considered they were not fractures, but merely developmental lines. He (the speaker) thought there was a good deal to support that view, because in certain cases of osteomalacia

one could find identical appearances—a line of rarefied bone having on either side a layer of compact bone, and these lines were often symmetrical. It was difficult to conceive of their being fractures when there was no evidence of trauma and they were so symmetrical. Paget's disease, osteomalacia, and fragilitas ossium, caused these marks on the convex surfaces.

The question of blood supply in relation to calcification and ossification cropped up in relation to the experiments of Bentzon, who considered that Ollier's disease was probably due to some defect of the sympathetic nervous system, and that the vessels became dilated as a result, and so the formation of these islands of cartilage occurred. Bentzon explained this on the finding that fracture of a long bone, where one normally found no cartilage, showed, after eight days, a mass of cartilage, which later ossified.

Dr. G. B. BATTEN said that, unlike Dr. Roberts, he could not even claim to be purely a radiologist, because, as a general practitioner, he had to diagnose these conditions as well as do his best to treat them satisfactorily. Taking the case of the ordinary fracture of the neck of the femur, it had always been felt that the limb should be immobilized for a time, and then massage and gentle movements be used to increase the degree of hyperæmia present; but that treatment now seemed to be wrong. Would Mr. Watson Jones give some hints as to treatment for the benefit of those who saw these cases in the course of general practice.

Dr. W. H. COLDWELL said that two common sites of calcification had not been mentioned; one was the pineal body and the other the costal cartilages. He would like to hear the reason for the early deposition of lime salts in the rib cartilages. Also, could any reason be given for the age-incidence of calcification being so widely varied? Some people had well-marked calcification of the costal cartilages as early as the twentieth year.

With regard to Paget's disease, he would like to know whether the increased calcification in that disease came under the general explanation which had been given. In this condition the surface cracks in bones were interesting, but if these cases were seen at a later stage the cracks would be found often to have been filled up with new bone in the same way as after real trauma. If these cracks were mere lines of demarcation one would not expect to see new bone on the surface.

Dr. H. B. SCARGILL (Leeds) said that Dr. Roberts had asked him to say a few words about a condition which Mr. Watson Jones had described and from which he (the speaker) had suffered, namely, supraspinatus tendonitis.

During the winter of 1929-30 he experienced pain at times in the region of the right shoulder and upper arm. He received treatment from several doctors, on the diagnosis of neuritis and muscular rheumatism. The pain was worse at night, and it was difficult for him to get the arm into a comfortable posture. It was a very intermittent pain, like that of toothache, and it appeared not to be influenced by movements of the arm or scapula. One night in March, while turning over in bed, he had an acute and agonizing pain in the shoulder region, with partial locking of the joint. After two days the pain moderated and the shoulder was examined by X-rays. A shadow was seen just above the head of the humerus. It was thought to be a piece of detached bone, but there was nothing to show where it had belonged. Sir Robert Jones advised the removal of the body causing the shadow, as he regarded it as extra-capsular, and thought it had been caught and wedged between the capsule of the shoulder-joint and the under surface of the acromio-clavicular joint, thus causing the locking. The speaker arranged for it to be removed, but owing to a severe cold postponed the operation; the pain eased, and he decided to wait. [Dr. Scargill showed successive skiagrams which evidenced the gradual disappearance of the offending body.] He had not had pain or discomfort since.

He attributed the onset to continual cranking up of his car, and the absorption to the elimination of the exciting cause and to rest.

Mr. WATSON JONES (in reply) said that Dr. Coldwell had referred to calcification of costal cartilages. There was no less vascular tissue than fibro-cartilage, and the question of age did not necessarily come into the problem. It was again an example of calcification of a functionless and degenerating tissue.

Dr. Brailsford had mentioned changes occurring in the scaphoid. Injury to this bone might cause traumatic hyperæmia and decalcification, with the appearance of cyst formation, even without a preliminary fracture, but he thought that this must happen very

rarely. A common condition, however, was a fracture of the scaphoid of so slight a degree that it was not revealed by X-rays on the first day of injury. It was not uncommon to suspect a fine linear crack in the scaphoid, but to have no definite radiological evidence until two or three weeks had elapsed. Then when the region began to decalcify the injury was obvious. He thought that Dr. Brailsford's cases were of this type. Kienboch's disease of the semilunar bone, to which reference had been made, was an excellent illustration of the theories under discussion. The sclerosis did not follow one single injury which would cause decalcification, but was the result of many minor injuries, together producing fibrosis and impairment of blood supply. The association of impaired vitality and increased calcification was the inevitable sequel.

Dr. Scargill's personal observations illustrated the reversibility of pathological calcification. Deposits produced by impairment of blood supply could be reabsorbed by a later hyperæmia. Only if the calcareous deposit was an extensive one did a secondary hyperæmia change it to bone.

This contribution was of course a joint one, and it indicated a happy association that radiologists and surgeons could co-operate in writing a paper. Radiology he considered to be as much a part of clinical surgery as clinical surgery should be a part of radiology.

Section of Therapeutics and Pharmacology.

President—E. P. POULTON, M.D.

[*December* 13, 1932.]

DISCUSSION ON THE NEW PHARMACOPŒIA.

Professor Francis R. Fraser: The British Pharmacopœia has hitherto not been read and not been used by most medical practitioners, and there is good reason for this, because it is a book of standards and not a book of prescriptions. When a therapeutic substance is ordered by a doctor, the pharmacopœia ensures that a reliable sample, as free as possible from toxic and other impurities, shall be dispensed, and the members of the Pharmacopœia Commission have had this purpose foremost in their minds throughout the compilation of the 1932 edition. If a substance cannot be defined with accuracy it has not been included, and if the active constituents or the potency of a substance cannot be adjusted to ensure a reasonably constant article it has not been included. As it is a book of standards, mixtures—and compound pills and powders which are simple mixtures of pharmacopœial drugs—have, as a rule, not been included, but a few, well-established and commonly used, particularly if their pharmacy is difficult, have been retained.

The trend of modern therapeutics is to use single drugs in a pure state, and simply prepared for administration to patients as a dry substance or a solution. As the use of complicated formulæ and of prescriptions with many ingredients becomes less—and it is becoming less—the pharmacopœia will become more valuable to the practising physician, and he need hardly ever prescribe a non-pharmacopœial remedy unless he is making therapeutic investigations on new substances.

The years between the publication of the last edition in 1914 and of the new edition in 1932 have seen advances in all branches of knowledge, and so it has been possible to modify and strengthen many of the requirements and tests for purity and to define with greater accuracy the physical and chemical characters to which a drug must conform. With these improvements I do not propose to deal, nor shall I recount the reasons why each of the 357 articles and preparations which were in the 1914 edition and are not in this edition, have been omitted; and I shall not try to explain why 128 articles and preparations which were not in the 1914 edition have been included in the new edition. I would, however, like to emphasize that the advice and evidence of many authorities in this country and in the Dominions were obtained before a decision was reached on any question.

A national and imperial pharmacopœia must mirror the therapeutic practice of the time, even if it is the more cautious and conservative practice, and when this edition is compared with the 1914 edition it is of interest to note what are the main

differences, apart from the changes in detail that I have mentioned. There are two changes that indicate the advances which therapeutics have made in the last twenty years. There are many more articles that are of curative value and not used merely in symptomatic treatment; antitoxic sera, vaccines, organic arsenicals, and a vitamin preparation find a place for the first time, and if insulin is not curative in the same sense, it is so nearly curative that it can be added to the list. Quinine is the only article in the 1914 edition that can be compared with these; and though preparations of mercury, bismuth and antimony were in the previous edition, they have been reconsidered and regulated in this edition with a view to their use by injection for curative purposes. The other great change which I see is designed to meet the demand for therapeutic precision. It is now possible in many cases to obtain active principles in pure chemical form so that a standard article is ensured. The inclusion of Emetine Hydrochloride allows of a therapeutic accuracy that could not be obtained with preparations of ipecacuanha, and Thyroxine-sodium and Ergotoxine-ethanesulphonate are similar examples of chemical standardization. With others, however, chemical standardization is not possible, and for the first time the principle of biological assay has been introduced. It is necessary that sera, preparations of vitamin D, insulin, pituitary extract, the organic arsenicals, preparations of digitalis, tincture of strophanthus, and strophanthin be assayed by biological methods that compare their activities with those of standard preparations, which are for the most part defined by international agreement and the League of Nations. When assayed, they must then be adjusted, so that they conform with the standard preparation or contain in a stated weight or volume a required number of units of activity.

Only four curative sera are included: Diphtheria Antitoxin, Tetanus Antitoxin, Gas-gangrene Antitoxin, and Antidysentery Serum (Shiga). In many bacterial infections the disease process involves the invasion of the body by the organisms and the setting free of endotoxins probably from the dead bodies of the bacteria, but these processes are but little understood. When anti-sera are prepared by the injection of the organisms into animals, protective bodies are produced, but what the properties of these bodies are is not yet known, nor is it known how they combat the infection, and there is no agreement as to how the potencies of such sera can be assayed. With diphtheria, tetanus, and gas-gangrene, on the other hand, it is exotoxins set free during the growth of the bacteria that damage the body tissues and not the invasion by the bacteria, and these toxins are easily obtained in the culture media when the organisms are grown under artificial conditions. Diphtheria antitoxin, tetanus antitoxin and gas-gangrene antitoxin are produced by the injection into animals of these toxins. Standard antitoxins for diphtheria, tetanus and gas-gangrene are kept by the Medical Research Council at Hampstead, and unknown samples are compared with these by testing their power to protect animals from the effects of the specific toxins, and are in this way assayed and standardized. In the case of Antidysentery Serum (Shiga), an exotoxin is present in the culture medium, and although the serum is usually prepared by bacterial injections and is therefore an antibacterial serum, it contains anti-exotoxin and can be assayed in respect to its antitoxic potency. It has therefore been included, but all other antibacterial sera have been omitted since their therapeutic potencies cannot be assayed by any generally accepted method. The reasons for this inclusion in the pharmacopœia of the four sera that can be standardized and for the omission of the others are instructive, and when they realize them many medical practitioners will, I believe, arrive at a clearer understanding of serum-therapy.

The substances required for Schick testing and for diphtheria prophylaxis have been included, and it is probable that before very long the corresponding substances

for the Dick test and for scarlet-fever prophylaxis will be so defined and standardized that their inclusion will be justified.

Of the vitamins, vitamin D alone can be obtained in a relatively pure form and be standardized. A preparation of this vitamin, the Solution of Irradiated Ergosterol, is defined as a solution in oil of the antirachitic principle. The solution is standardized in terms of the international unit, by comparing its value in the cure and prophylaxis of rickets produced experimentally in rats with that of the standard preparation. The production of calciferol was announced while the Pharmacopœia was in the press, and this will probably result in the solution of irradiated ergosterol being made by dissolving calciferol in a suitable oil. Since Cod-Liver Oil is used for purposes other than the treatment of rickets, and because its value, other than that due to the vitamin D which it contains, is not yet clearly defined, it was not considered justifiable to insist on its being standardized in respect to vitamin D. It contains vitamin A, and there is still uncertainty as to whether the antimony trichloride test is a test for vitamin A, but the quantitative results obtained by means of this test run parallel with those obtained by biological tests of the growth-promoting properties of preparations of this vitamin, and this test has been included in the requirements for Cod-Liver Oil so as to ensure that samples of cod-liver oil will be at least good samples in this respect. Doubtless, in a very short time the requirements for cod-liver oil will become more exacting. At present there is not sufficient knowledge of vitamins B and C to justify the inclusion of any preparations of them.

It is hardly necessary for me to point out the similar reasons that have resulted in the inclusion of Insulin and of Pituitary (Posterior Lobe) Extract and the methods for their biological assay, and the omission of other glandular hormones. The official preparation of the thyroid gland does, however, deserve a few words. In the past when thyroid gland was prescribed there was uncertainty in the minds of physicians and dispensers as to whether the dosage was expressed in terms of fresh gland, of unofficial extracts, or of the official dry thyroid. Thyroideum or Thyroid is now the official preparation, and it is a dry powder standardized to contain a definite amount of thyroxine iodine ; thyroideum siccum, dry thyroid, thyroid extract and thyroid gland are all official synonyms, so that, whatever term is used in prescribing, only one standardized substance can be dispensed. Much confusion and uncertainty will in this way be eliminated, and precise therapy with this very important and potent remedy will be possible.

Arsphenamine, or salvarsan, has not been included, because it appeared from the evidence obtained that it is seldom used, neo-arsphenamine having replaced it for intravenous injection. Sulpharsphenamine has a definite place in therapeutics because it can be given by intramuscular or subcutaneous injection, so Neo-arsphenamine and Sulpharsphenamine appear as the first representatives of the new chemotherapeutic substances. They cannot be chemically standardized, and they must be assayed biologically to ascertain that their curative potency is not less than that of the standard preparation, and that their toxicity does not exceed that of the standard preparation by 20%.

An important advance in the direction of therapeutic precision has been effected by the standardization of the preparations of digitalis, of tincture of strophanthus and of strophanthin. It is not yet possible to obtain the active principles of digitalis in chemically pure form, so that digitalis preparations cannot be standardized by chemical assay. The most stable form of digitalis is the dried powdered leaf, and by international agreement a standard for digitalis has been fixed in terms of a standard digitalis powder, and the unit of activity is the activity of 0·1 gramme of this standard powder. The Pharmacopœia describes Digitalis Leaf which must conform to certain specifications but is not standardized, and from

it is prepared Powdered Digitalis which must be standardized for therapeutic administration and have the same activity as the international standard powder; biological methods of assay are given in the Pharmacopœia for comparing the activity of unknown samples with that of the standard by means of their lethal effects on frogs or on cats. Infusion of Digitalis must be a fresh infusion and must be prepared from the standardized powder. Tincture of Digitalis may be prepared from the standardized powder to contain the activity of 0·1 gramme in 1 c.c., or may be prepared from unstandardized leaves, but in this case it must then be assayed and adjusted to contain the activity of 0·1 gramme of the standard powder in 1 c.c. The convenience of the standardized powder, its stability and its efficiency when administered by the mouth make it a most suitable form for the therapeutic administration of digitalis, and its use is rapidly extending in this and other countries.

Although the action on the heart of strophanthus is qualitatively similar to that of digitalis, tincture of strophanthus cannot be standardized against the standard digitalis powder, because the relation between the therapeutic and lethal doses is not the same in the two cases. A national standard for Tincture of Strophanthus has been adopted, and tincture of strophanthus for therapeutic purposes must be assayed and adjusted so that its activity is the same as the activity of the standard tincture. Strophanthin similarly must be standardized in terms of a standard strophanthin. The Commission recognized the need for a digitalis preparation suitable for subcutaneous or intramuscular injection, but concluded that no such preparation was yet obtainable, the insolubility of the glucosides when isolated in a state approaching purity being one of the main difficulties, as this necessitated the use of an undesirable bulk of solution in order that doses could be administered of the size usually required when injections are necessary.

There are many features of this Pharmacopœia that deserve attention, and I know that there is much to criticize. I have drawn attention to a few of the additions and alterations that I think are of special importance, and which seem to reflect the great advances in curative treatment and the increasing precision of modern therapeutics. I believe that they illustrate also the value of international agreement in promoting the health of man.

Dr. C. H. Hampshire: I propose to supplement what Professor Fraser has said by drawing attention to some of the more important points in the chemical and pharmaceutical side of the work.

The new Pharmacopœia is essentially a book of standards, and the Pharmacopœia Commission may justly claim to have utilized all the appropriate resources of chemical, physical and pharmaceutical science in bringing those standards into line with the modern requirements of the medical profession, and in defining the methods of manufacture which are most suitable for present-day purposes.

This is not the place, however, to discuss the details of analytical methods or pharmaceutical processes and these remarks will be restricted to indicating some features of the materials which are introduced for the first time into the Pharmacopœia, the principal alterations in respect of materials described in previous Pharmacopœias, and one or two related subjects.

Some of the new chemical drugs which have been introduced may be first touched upon. These are mostly substances which have been used in medicine for a long time, but are now, for the first time in this country, described authoritatively and characterized by appropriate tests for ensuring their purity and activity. There is no need to do more than draw attention to the names by which they have been formerly known, and it may be useful to group them according to therapeutic effect.

Hypnotics: Barbitonum Solubile (*Veronal-sodium, Medinal*), Carbromalum (*Adalin, Uradal*), Phenobarbitonum (*Luminal, Gardenal*), Phenobarbitonum Solubile (*Luminal-sodium*).

Local anæsthetics: Amylocainae Hydrochloridum (*Stovaine*), Benzocaina (*Anæsthesine, Ethyl Aminobenzoate*), Orthocaina (*Orthoform*), Procainae Hydrochloridum (*Novocain, Ethocaine, Kerocain*).

Antiseptics: Acriflavina (*Flavine*), Chloramina (*Chloramine T.*), Hydrargyri Oxycyanidum.

Diuretics: Caffeina et Sodii Benzoas, Theophyllina et Sodii Acetas (*Theocin sodium acetate*).

Anthelmintics: Carbonei Tetrachloridum (*Tetraform*), Oleum Chenopodii.

Drugs used in Tropical Diseases: Antimonii et Sodii Tartras, Emetinae Hydrochloridum, Emetinae et Bismuthi Iodidum, Totaquina. The last-named drug is a preparation of the alkaloids of cinchona bark which has been worked out specially to provide a cheap drug for the treatment of malaria among indigent populations. The work has been done at the instance of the Health Organization of the League of Nations, and the English member of the Committee responsible for Totaquine, Dr. T. A. Henry, pressed forward his work in order that the drug could be described in the new British Pharmacopœia. The League of Nations Committee have not quite completed their work, but it is expected that they will report substantially in favour of the standards described in the British Pharmacopœia.

Oleum Hydnocarpi replaces the Oleum Chaulmoograe of the previous Pharmacopœia and Oleum Hydnocarpi Aethylicum is a new preparation consisting mainly of the ethyl esters of chaulmoogric and hydnocarpic acids, which is prepared from hydnocarpus oil for use in the treatment of leprosy.

Diagnostic agents: Indicarminum (*Indigo Carmine*), Iodophthaleinum (*Tetraiodophenolphthalein sodium, Iodo-ray, Tetiothalein sodium, Iodeikon, Opacin, Cholumbrin, T.I.P.*, etc.), Methylthioninae Chloridum (*Methylene Blue*), Fluoresceinum Solubile, Barii Sulphas, Laevulosum, Urea.

Anæsthetics: In addition to a careful revision of the tests to be applied to Chloroform, the Pharmacopœia now includes a special anæsthetic quality of Ether, under the name of Aether Anaestheticus, which is carefully characterized by stringent tests. Four gases are described, which are of importance to anæsthetists—Aethylenum, Carbonei Dioxidum, Nitrogenii Monoxidum, Oxygenium. In drawing up the tests particular care has been taken to limit the amount of noxious gases, such as carbon monoxide. In this section of their work the Commission had the benefit of the assistance of Professor Henderson of Toronto and of the Anæsthetics Committee of this Society.

Miscellaneous: Ichthammol (*Ichthyol, Ammonium Ichtho-sulphonate*), Cinchophenum (*Phenylcinchoninic acid, Atophan, Agotan, Phenoquin*, etc.).

Ephedrinae Hydrochloridum: The crude drug, Ephedra, which has received so much attention in recent years, is not included; the pure alkaloidal salt is readily obtainable and is to be preferred to galenical preparations of the crude drug.

Dextrosum: This is the pure powdered carbohydrate. The Pharmacopœia also describes, under the name of Glucosum Liquidum, the material which was named glucose in the British Pharmacopœia, 1914. The name glucose is not now used in the Pharmacopœia, and there is a possibility of confusion if it is used in prescriptions or orders. It is hoped that prescribers will specify Dextrose when they require the pure carbohydrate, and Liquid Glucose when they require the syrupy mixture of dextrose, maltose, etc., which was formerly known as glucose.

Erythritylis Tetranitras Dilutus: Under this name a mixture of equal parts of the pure erythrityl tetranitrate and lactose is described. This is the form in which

the substance is used in commerce, as pure erythrityl tetranitrate is too explosive to be handled. The dosage mentioned in the Pharmacopœia is adjusted accordingly, and the dispenser is instructed that when Erythrityl Tetranitrate or Erythrol Tetranitrate is prescribed, twice the prescribed amount of the pharmacopœial preparation must be dispensed.

It will be useful now to draw attention to some new pharmaceutical preparations which appear in the Pharmacopœia.

Injections.—Although the simple solutions of drugs which were described in former Pharmacopœias as injections are not now included, a number of new injections have been introduced. These are preparations which call for description on account of the complexity of the manner of their preparation. Injectio Bismuthi is a 20% w/v suspension of precipitated bismuth in an aqueous medium containing dextrose and cresol. Injectio Bismuthi Salicylatis is a 10% w/v suspension of bismuth salicylate in olive oil containing camphor and phenol. Injectio Ferri is a solution of a citrate of iron and ammonia prepared by a special process, and contains in a dose of 30 minims the equivalent of about $\frac{1}{10}$ grain of iron. Injectio Hydrargyri (*Mercurial Cream*) is a 10% w/v suspension of metallic mercury in a medium containing olive oil, wool fat, camphor and creosote. Injectio Hydrargyri Subchloridi (*Calomel Injection*) is a 5% w/v suspension of mercurous chloride in a basis containing olive oil, wool fat, camphor and creosote. Injectio Sodae Chloridi and Acaciae is the usual Bayliss Solution containing 0·9% w/v of sodium chloride and 6% w/v of acacia. Directions for the sterilization of all these injections are included in the monographs.

Oculenta.—A group of ointments for the eye has been introduced. The description takes the form of a general method accompanied by the statement that the percentage quantity of a drug to be contained in each ointment for the eye is stated by the prescriber. At the same time, it is recognized that pharmacists may sometimes receive prescriptions from which the prescriber has omitted the strength, and the Pharmacopœia lays down standards for the strengths of some of the commoner eye ointments which are to be used when the strength is not stated.

Suppositories are dealt with in a similar manner.

The new materials introduced into the Pharmacopœia contain instances of preparations which represent advances in pharmacy and which call for description in order that definite standards may be available. Concentrated infusions, Concentrated Aromatic Waters, Methylated Liniments are now brought under control by inclusion in the Pharmacopœia. Some well-known preparations which now find inclusion are:—Gelatinum Zinci (*Unna's Paste*), Pasta Zinci Oxidi Composita (*Zinc Paste*), Syrupus Ferri Phosphatis Compositus (*Parrish's Food, Parrish's Syrup, Chemical Food*), Mistura Magnesii Hydroxidi (*Cream of Magnesia*), Cataplasma Kaolini (*Kaolin Poultice*), Extractum Malti cum Oleo Morrhuae.

Changes in strength and composition of preparations.—Some important changes only need be mentioned.

Ergota: For some years past the standardization of ergot and its preparations has been carried out biologically, but the work of the Sub-Committee on Ergot made it possible to utilize a chemical colorimetric test. The basis of the standardization is the acceptance of the alkaloid, ergotoxine, as the active principle of ergot. The physiologically inert alkaloid, ergotinine, also gives the colour reaction, but experiment showed that the variation in the proportions of ergotoxine and ergotinine in ergot is not greater than the experimental error, and it is possible, therefore, to standardize ergot and its preparations on total alkaloids calculated as ergotoxine.

Ergot, the crude drug, is described, and from this a standardized defatted powder, Ergota Praeparata, is made. This, if kept in an air-tight container, is more stable than powdered ergot from which the fat has not been removed, and it also retains its

activity better than the liquid extract. It provides a convenient stable form of ergot for oral administration. A footnote to the monograph on Ergot ensures that the standardized preparation will be dispensed when Ergot is ordered.

Extractum Ergotae Liquidum : The liquid extract is prepared from defatted ergot by means of an alcoholic menstruum containing tartaric acid. The product is standardized to contain 0·06% of total alkaloids calculated as ergotoxine. The storage directions state that liquid extract of ergot loses activity rapidly at ordinary temperatures and slowly at 0° C. It is directed that the liquid extract should be kept in completely filled containers and stored in as cool a place as possible. The instability of the liquid extract is recognized in the statement that after storage it contains not less than 0·04% of total alkaloids. The necessity of following as closely as possible the recommendations regarding storage will be appreciated.

Ergotoxinae Aethanosulphonas: This chemical has been introduced as the most suitable form for securing the effects of ergot by subcutaneous or intramuscular injection, and the hypodermic injection of ergot of former pharmacopœias has been discarded.

Liquor Arsenicalis (*Fowler's solution*) is now a colourless, neutral solution of the same arsenical content as formerly. The change in reaction has been made in conformity with the International Agreement in order to overcome the disadvantages of incompatibility associated with the older alkaline and acid preparations.

Syrupus Ferri Phosphatis cum Quinina et Strychnina: This has now the name Easton's Syrup as a synonym. The proportion of strychnine has been reduced to one-half and some glycerin has been included in the formula with a view to increasing the stability.

Senna.—Some changes in the composition of the senna preparations have been made. The powdered leaf, as formerly, is used in preparing confection of senna and compound liquorice powder. The liquid preparations are made from the fruit, which is usually considered to yield milder preparations than the leaf, provided that the seeds are not broken.

Squill.—The vinegar and the tincture have been reduced to one-half the strength of the corresponding preparations of the British Pharmacopœia, 1914, and the doses have been doubled. The oxymel now contains active constituents approximately equivalent to 5% w/v of squill and is of about two-thirds the strength of the corresponding preparation of the British Pharmacopœia, 1914. Syrup of squill has been slightly increased in strength, and now contains active constituents approximately equivalent to 4·5% of squill. The doses of the two latter preparations have not been changed. The preparations are not standardized biologically for reasons which are given in the Introduction to the Pharmacopœia.

"... different samples of tincture of squill show much more uniformity of activity than do different samples of tincture of digitalis; the biological assay measures the cardiac glucosides present, and these may not be responsible for the expectorant action for which squill is mainly used; no standard for squill is recommended by the Permanent Commission on Biological Standardization."

Nomenclature.—In making alterations in the names of drugs which occurred in the British Pharmacopœia, 1914, and in giving names to new drugs, the Pharmacopœia has been brought into line as far as possible with the International Agreement and the United States Pharmacopœia X. Correct chemical names are used whenever possible and where names have been changed, the former names are included as synonyms, which, as explained in the General Notices, are official titles.

Doses: In the new Pharmacopœia, the doses stated for a number of important drugs have been changed. The General Notices make it clear that the doses are not authoritatively enjoined as binding upon prescribers, but are included merely for general guidance. The only reason for mentioning them to a medical audience is that the Pharmacopœia places upon the pharmacist or dispenser, when an unusually large dose appears to have been prescribed, the duty of satisfying himself that the prescriber's intention has been correctly interpreted. It may be that some of the changes in dosage will lead to prescriptions being referred back by pharmacists because the doses of certain highly potent drugs have been changed. As instances, the following increases in maximal doses may be cited:—

Arseni trioxidum	$\frac{1}{16}$ gr.	becomes	$\frac{1}{12}$ gr.
Atropina Atropinae sulph.	$\frac{1}{100}$ gr.	,,	$\frac{1}{60}$ gr.
Strych. hydrochlor.	$\frac{1}{18}$ gr.	,,	$\frac{1}{8}$ gr.
Thyroideum	4 gr.	,,	5 gr.
Tinct. bellad.	15 min.	,,	30 min.
Tinct. nuc. vom.	15 min.	,,	30 min.

Some reductions of dosage may be cited also:—

Ext. ergot. liq.	30 min.	becomes	20 min.
Ext. hyoscy. sicc.	8 gr.	,,	1 gr.
Hydrarg. subchlor.	5 gr.	,,	3 gr.
	(By intramuscular injection 1 gr.)		
Liq. morph. hydrochlor.	60 min.	becomes	30 mins.
Phenacetinum Phenazonum	15 gr.	,,	10 gr.
Pulv. ipecac. et opii	15 gr.	,,	10 gr.

Sterilization.—The general increase in the administration of drugs by injection has led to the inclusion in the Pharmacopœia of instructions for the sterilization of suitable materials. General methods are described in an Appendix and the special application of these methods to drugs is included in the individual monographs. The three principal methods are: heating in an autoclave, Tyndallization, and filtration. A special method for the sterilization of oily solutions is described; also an Emergency Method requiring the use of aseptic technique and the addition of 0·5% of phenol or a corresponding proportion of another equally effective antiseptic. Solutions prepared by the Emergency Method must be used within four days, and if the solution is intended for intravenous injection the antiseptic is omitted. It is the duty of the dispenser to inform the prescriber when, for any reason, the Pharmacopœial methods cannot be applied. It is expected that pharmacists will be prepared to carry out the preparation of all sterile materials for injection, which may be required by the medical profession, and the directions in the Pharmacopœia will facilitate the adoption of the more accurate method of medication by injection in preference to the administration of drugs by mouth.

Dr. J. Stanley White said he regretted that it had not been possible to include scarlet fever antitoxin in the new Pharmacopœia seeing that it represented perhaps the most important advance in serum-therapy since Behring first put forward his principles as far back as 1891. It was significant that the authorities in Washington had recently accepted the Dick Standard, although he quite understood that there was, at the moment, no international agreement in regard to the methods employed for standardizing the product.

He was somewhat surprised at the inclusion of diphtheria toxin-antitoxin, seeing that opinion in this country was definitely opposed to this combination.

He questioned whether the so-called "blue test" for vitamin A could be regarded as reliable, in view of the spectrographic work done by Heilbron and Morton. In many cases the two tests ran almost level, but occasionally there was a wide difference, presumably due to some inhibitory factor in the oil under examination.

With regard to the standardization of digitalis, he regretted that the cat method had been recognized as well as the frog method. It was an undoubted fact that whereas two fresh samples of digitalis would give results almost identical by either method, an old tincture by the cat method would show the preparation to be quite active whereas, therapeutically, it might be almost inert.

As to the standard laid down for thyroid: Many workers were not prepared to accept thyroxine as necessarily representing the whole of the activities of the thyroid gland, and it was a matter of some surprise that the new Pharmacopœia had ruled that the standard should be in terms of iodine in combination as thyroxine

Mr. R. R. Bennett said that he could think of no instances in which the standards set by the new Pharmacopœia had resulted in increased costs which would impose hardship upon users. He thought it was noteworthy that apart from natural products of vegetable origin, the majority of the official chemicals were produced by British manufacturers. A considerable number of the substances which became official for the first time in the 1932 Pharmacopœia, provided the prescriber with products identical in composition with certain proprietary drugs of foreign origin.

Speaking as one of the pharmaceutical members of the Pharmacopœia Commission, he was gratified to find that the new Pharmacopœia was generally acceptable to pharmacists, and the pharmaceutical profession as a whole had greatly welcomed the official recognition which pharmacy had received for the first time in the compilation of a British Pharmacopœia.

Mr. A. L. Bacharach said that lemon juice would presumably afford a more constant source of vitamin C than orange juice, since the Permanent Commission on Biological Standardization of the Health Organization of the League of Nations had recommended it as the international standard, but he imagined that no citrous juice would be suitable for inclusion in the Pharmacopœia, owing to its lack of keeping properties. Even if the cost of biological standardization had to be included in the cost of a finished and packed pharmaceutical product, it was probable that a physician would be receiving, unit for unit, better value in post- than in pre-standardization days. He doubted whether the spectrographic method of assaying vitamin A would ever be suitable for inclusion in the Pharmacopœia, owing to the specialized technique required for carrying it out and the expense of the apparatus. The antimony-trichloride test, if modified in certain ways that had been published, would give very nearly as accurate results, and the Commission had, in his opinion, been unduly cautious in disclaiming for it any quantitative significance. He had no doubt that an oil with a low blue value would always be poor in vitamin A and that an oil with a high blue value would always be rich in it, even though oils could not be accurately graded in the exact order of their blue values. Finally he urged that the Commission should discourage, officially or unofficially, the use of the phrase "B.P. units" to describe any unit that was made the basis of a Pharmacopœial standard, whether for vitamins, or endocrine products, or other biologically assayed material. This would only add to existing confusion about biological units, and was no more justifiable than replacement of the phrase "degrees centigrade" by the phrase "degrees B.P."

[*February* 14, 1933.]

DISCUSSION ON THE USE OF IODINE COMPOUNDS IN THE TREATMENT OF THYROID DISEASE.

Professor C. R. Harington: (*Historical aspect*). The use of iodine in disorders of the thyroid, particularly in Graves' disease, is a subject about which there is considerable discussion and concerning which widely divergent views are held. I think, therefore, that it may be profitable to consider the factors responsible for the development of this method of treatment and further to consider those chemical and physiological properties of the thyroid which have a direct bearing on the problem and which may enable us to reach a theoretical conclusion concerning the soundness or otherwise of the treatment adopted.

In the first place I should like to say something about simple goitre, since although the successful solution of the problem of the prophylaxis of this disease is now a matter of common knowledge, there can be few cases which afford a clearer illustration of the development of a method of treatment from empiricism to a securely established scientific therapy.

It is said that a soup made from seaweed was employed by the Chinese in the treatment of goitre many centuries B.C. Of the authority for this statement I am not certain; the earliest reference bearing on the present discussion which I have myself been able to trace is contained in the writings of Arnaldus Villanovanus (thirteenth century, A.D.); this author discusses the medical treatment of goitre at some length and proposes as a specific remedy a preparation containing, among other constituents, burnt sponge and seaweed. A similar prescription, evidently derived from that of Arnaldus, appears in the *Philonium Cheirurgicum* of Valescus de Taranta (1418), and again, in 1698, we find Musitanus recommending burnt sponge as a specific for enlargement of the thyroid. The prescription of the last-named author is much simpler in character than those of Arnaldus and Valescus; it is clear that he recognized the burnt sponge to be the essential active constituent and he even goes so far as to describe as "praejudicium vulgi" the requirement insisted upon by his predecessors that the remedy must be taken during the wane of the moon.

The use of burnt sponge in the treatment of goitre does not seem to have been taken up in this country until the middle of the eighteenth century when it appears in a curious manner as the "Coventry Treatment" for goitre. The nature of this treatment remained a secret in the possession of a family at Coventry for many years before it was finally divulged to a Dr. Wilmer who published a full account of it in 1779. The prescription given by Wilmer is an almost literal translation of that of Musitanus; it is amusing to note, however, that Wilmer was not so free from the "praejudicium vulgi" as his predecessor, for he includes the requirement that the remedy shall be taken during the wane of the moon and naïvely concludes "Some parts of these directions seem to bear the character of empiricism; but where no harm can possibly arise from, nor inconvenience follow their use, it is to be wished that those who think proper to give the preceding method a trial, will do so in the manner recommended."

Wilmer's account of the "Coventry Practice" found its way almost verbatim into Parr's *London Medical Dictionary* (1809) and the burnt sponge remedy was accepted by Foderé (1800) as a true specific in the treatment of goitre; it was evidently generally regarded at this period as a valuable, if empirical, remedy for the disease, the only objection to its use being its liability to cause gastric disturbances.

The active constituent of burnt sponge.—During the Napoleonic Wars there was a serious shortage of nitrate for the manufacture of gunpowder in France. The difficulty was met by the cultivation of nitre beds. These were usually made by mixing soil with nitrogenous refuse and making the mixture alkaline by addition of lime so that the nitric acid produced by bacterial action was first obtained as calcium nitrate. In order to convert the latter into saltpetre it was then treated with an extract of wood-ashes.

In 1812 a manufacturer of saltpetre in the neighbourhood of Paris, Courtois by name, began to use an aqueous extract of varec or kelp (burnt seaweed) in place of the extract of wood-ashes for the decomposition of the calcium nitrate. As a result of this change of procedure, his copper vats became seriously eroded, and he traced the noxious agent to the final mother-liquor obtained after removal of as much as possible of the nitrates by crystallization. When he heated some of this mother-liquor in a retort with strong sulphuric acid a vapour "of a superb violet colour" was evolved which condensed in plates in the neck of the retort.

The new substance was brought to the notice of Gay-Lussac, who showed, a year later, that it was an element having close affinities with chlorine, and named it from the colour of its vapour, iodine.

Six years later the new element was shown by Fyfe (1819) to be abundantly present in the ash of the common sponge.

In the same year Coindet, a Geneva physician, in ignorance of Fyfe's demonstration, but knowing that sea-water itself had been recommended by Russell (1750) as a cure for goitre, was inspired with the idea that this element, newly discovered in seaweed, might well be the active principle of the time-honoured burnt sponge remedy. His first experiments to test this hypothesis met with astonishing success.

First use of iodine in treatment of goitre.—Iodine was given by Coindet either in solution in potassium iodide or as the alcoholic tincture, the dose being 1·5 gr. of iodine daily, increasing after a week to 2·25 gr. and later to 3 gr. Under this treatment goitres of large size and long standing began already in from eight to ten days to soften and diminish in size, and if the treatment were maintained the swelling usually completely disappeared in from six to ten weeks.

It soon became apparent that the administration of so drastic a therapeutic agent was not without danger, and in his second memoir Coindet (1820) emphasized the need of caution in the use of the new drug. He stated that the total amount of iodine required for treatment should not exceed 2 oz.; the optimal dose, however, varied greatly in different cases. Untoward symptoms (palpitations, tremors, wasting, etc.) never showed themselves until the action of the iodine on the goitre was manifest, but the appearance of such symptoms should be regarded as the signal for an immediate intermission of the treatment. Iodine could be more safely, but less effectively, administered by inunction of an ointment containing potassium iodide over the goitre itself.

The early successes of Coindet were so dramatic, however (according to St. Lager [1867], people even took to carrying little bottles of iodine hung round their necks like amulets), that it was inevitable that his later warnings should be neglected, and a good deal of trouble ensued from the lavish employment of iodine by less cautious practitioners. A vivid picture of some typical results of carelessness of this sort is given by Gairdner, (1824), who writes: "So great have been the ravages committed by the imprudent use of iodine in the Pays de Vaud, that the government of that canton has issued an injunction against its sale, excepting under the signature and responsibility of a physician." Nevertheless, Gairdner himself was convinced that iodine, properly handled, was a drug of the greatest value.

"Iodine . . . is a real 'heroic remedy'—a true present from the science of medicine to mankind."

Favourable results in the treatment of goitre with iodine were recorded by numerous other physicians in this country (cf. Appendix to Translation of Coindet's *Memoirs*, 1824; Manson, 1825; Inglis, 1838); and by Morel (1864), who recommended the suspension of a bottle of iodine under the bed-curtains as a convenient and safe method.

The next line of evidence pointing to the essential importance of iodine in the economy of the thyroid was provided by the work of Chatin from 1850-1854, which demonstrated quite clearly a direct correlation between the occurrence of endemic goitre and environmental deficiency of iodine. The almost universal scepticism with which the important results of Chatin were regarded, however, prevented his discovery, for the time at least, from bringing about a notable advance in understanding of the thyroid problem; it was not until some seventy years later that Chatin's theory was vindicated by the work of such investigators as McClendon in America, von Fellenberg in Switzerland, and Hercus, Benson and Carter in New Zealand, with the result that now the adoption of iodine prophylaxis for endemic goitre is meeting with universal success.

Before the end of the last century, however, two fundamental observations were made which provided a logical justification for many of the results of the earlier workers; these were the demonstration by Murray in 1891 that the thyroid actually secreted an active principle which could be employed in replacement therapy where normal thyroid function had been lost, and the discovery by Baumann in 1895 that iodine was a normal constituent of the thyroid gland itself and was apparently associated with the physiological activity of this organ.

The observation of Baumann led, on the one hand, to the extensive chemical investigation of the thyroid which has finally resulted in the isolation of the iodine-containing active principle and to its identification and synthesis, and on the other to the morphological-chemical studies of Marine which have a direct bearing on iodine therapy.

It had early been observed that the iodine content of thyroid glands showed variations under pathological conditions, running, in general, parallel with the colloid content, so that a parenchymatous goitre containing little or no colloid might be almost free from iodine, whilst a colloid goitre might contain very large quantities. Marine's essential contribution consisted in the correlation of these observations upon a basis of concentration rather than total content of iodine, for he was able to show that the least departure from the normal structure of the gland in the direction of glandular hyperplasia was accompanied by a marked fall in the iodine concentration; in general, iodine concentration was inversely proportional to the degree of glandular hyperplasia. Conversely, restriction of exogenous iodine could be used as an experimental means of inducing a hyperplasia of the thyroid, entirely analogous to that elicited by sub-total thyroidectomy, whilst administration of iodine would prevent the development of thyroid hyperplasia under these conditions and would bring about involution of an existing hyperplasia. These observations seem to me to afford the only reasonable basis for a consideration of iodine therapy in Graves' disease.

From the time when it was first recognized that Graves' disease was associated with pathological change in the thyroid, iodine was tried from time to time as a remedy, on the basis of the success which had been met with in its use in simple goitre. Although isolated good results were obtained—as for instance in the frequently quoted case in which Trousseau prescribed iodine accidentally—the majority of workers on Graves' disease reported unfavourably regarding iodine therapy, a conclusion which seemed eminently reasonable on the assumption that the

symptoms of the disease were caused by over-production of an iodine-containing active principle. This view was urged particularly by Kocher, who regarded Graves' disease as being due to a "thyroid diarrhœa," the active principle being synthesized by the gland at a rapid rate and immediately released. Kocher moreover emphasized the danger, already realized in the early days of iodine therapy, of precipitating incipient Graves' disease or adenomatous goitre by administration of iodine into a condition of severe hyperthyroidism ("Jod-Basedow").

There existed, however, another theory of Graves' disease, originated by Möbius in 1896, which regarded the condition as dysthyroidism rather than hyperthyroidism. Reverting to this theory, nearly thirty years later Plummer extended it by assuming that the thyroid in Graves' disease produced a toxic secretion which owed its abnormality to deficiency of iodine. On this assumption is based the method of intensive iodine therapy in Graves' disease advocated by Plummer and now widely practised. The discussion of the details of this therapy I must leave to subsequent speakers but I wish to emphasize that the direct study of derivatives of thyroxine, particularly of those deficient in iodine, has afforded no justification for the assumption on which it is based and that the correctness of this assumption is in any case denied by the limited period during which iodine therapy exercises its good effect.

Moreover, if we consider the morphological reaction of the thyroid in Graves' disease to administration of iodine, we find that it conforms to the general rules laid down by Marine. The thyroid in Graves' disease usually shows a high degree of glandular hyperplasia; it contains little colloid and little iodine. The response to iodine therapy consists in rapid involution of the hyperplasia with storage of colloid and of iodine, and it is only during this period of involution that the remission of symptoms appears to persist.

Furthermore, the argument in favour of the dysthyroidism theory—which is based on the failure or positively harmful effect of iodine therapy in adenomatous goitre—is fallacious, since it has been quite clearly shown by Marine that adenomata of the thyroid, whilst they must be regarded as representing functioning thyroid tissue, are distinguished by the fact that they do not respond to variations in the iodine supply in the manner characteristic of the ordinary gland tissue.

I am therefore of the opinion that the "thyroid diarrhœa" suggestion of Kocher expresses the truth of the matter and that the temporary good effect of iodine therapy in Graves' disease is to be explained on some such lines as those suggested by Marine, namely, by a temporary arrest of this "diarrhœa" owing to pressure retention of the secretion during the period when the structural elements of the gland are adjusting themselves to the rapid involution. The cause of the "thyroid diarrhœa" is, I believe, to be sought outside the thyroid gland itself, possibly in the release of a control normally exercised by the suprarenal cortex or in an interaction of the pituitary with the thyroid.

If we accept such a hypothesis, we must admit that iodine therapy in Graves' disease cannot, any more than the surgical treatment with which it is frequently reinforced, claim to be more than a palliative measure which will only hold its own so long as we remain in ignorance of the real cause of the malady.

As a palliative or pre-operative treatment iodine therapy is, however, at present of unquestionable importance, and I should like to conclude with a practical suggestion, the only one which I am able to make, concerning the most suitable mode of administration of the iodine. The constitution of thyroxine, and the fact that this compound occurs in the thyroid together with diiodotyrosine, makes it almost certain that the biological synthesis of thyroxine takes place from tyrosine through the stage of diiodotyrosine and also that the latter is an essential constituent of colloid. Now if we accept the view, mentioned already, that pressure retention

of the secretion is the mechanism through which iodine exercises its temporary good effect, it is evidently desirable that the action of the iodine should be elicited as rapidly as possible. Attempts to achieve this object by the massive administration of elementary iodine or iodides are open to the objection of the risk of producing iodism; this risk can be avoided and at the same time the processes to which the iodine must be subjected in the body can be shortened by one stage if the iodine be given in the form of diiodotyrosine. Some promising experiments in this direction have already been made and I suggest that the method is worthy of a more extended trial.

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Dr. H. Gardiner-Hill (*Clinical Aspect*): A discussion on iodine in relation to thyroid disease from the clinical aspect really amounts to a consideration of the value of iodine in the treatment of simple goitre and toxic goitre. Most clinicians would, I fancy, agree that iodine plays little or no part in the treatment of cretinism or myxœdema, or, for that matter, of frank hypothyroidism, even when it develops in an individual who has had a long-standing simple goitre. The treatment for these conditions is thyroid extract, a therapeutic measure which does not quite come within the scope of this discussion. I shall therefore confine myself to the problems of iodine in the treatment of simple and toxic goitre.

Iodine as a therapeutic measure in simple goitre.—Professor Harington has given you an account of early therapeutic experiences with iodine in simple goitre, and of the various theories on which this treatment was based. He has described the views of Marine, who regards simple goitre as a compensatory hyperplasia, or work hypertrophy, of the thyroid for absolute or relative lack of iodine. Some authorities, as you know, are of the opinion that iodine is not the only factor; McCarrison, for instance, has put forward his views about the relation of goitre to dietetic deficiency.

Most of the simple goitres which we are called upon to treat in London are of the sporadic variety. Perhaps in about 10% of cases the goitre originated in an endemic area and subsequently the individual migrated. A review of my own cases shows that a very large proportion of sporadic simple goitres develop during the period of puberty and maximum growth, or during pregnancy and lactation, or at the climacteric. In others the condition has arisen after an infective illness. These are data which, I think, can be very well accounted for on Marine's theory.

Before passing on to the clinical and therapeutic aspects of the iodine problem, there is one recent paper which I should like to mention which shows the importance of systemic infections and their capacity to produce changes in the thyroid gland. Womack and Cole found, a few years ago, that very definite chemical, as well as histological, changes could be demonstrated in the thyroid after infections. These changes were enlargement of the gland macroscopically, and

microscopically desquamation and death of many of the acinous cells, with loss of colloid and hyperplasia of many of the remaining cells. Chemically, the iodine content per gramme of tissue was much reduced. In a second and recent paper they showed that experimental infections in animals produced similar changes in the thyroid, which were associated with a rise in basal metabolism. Iodine feeding prevented these changes and lowered the basal metabolism. This work, though it needs confirmation, has, I think, an important bearing on our discussion.

I must next briefly refer to the clinical types of simple goitre, as their recognition is important from the point of view of iodine treatment. Clinically, the goitre may be diffuse or nodular. The former is usually referred to as the diffuse colloid type of gland, the latter as the adeno-parenchymatous. Some authorities regard the first type as a simple hypertrophy, with enlargement of the gland and the colloid vesicles, whilst the second type is regarded as a simple hyperplasia in which new gland tissue has been laid down. This is a somewhat controversial problem. Much argument has centred around the question as to whether these varieties are separate entities, or whether the nodular is not merely a later stage of the diffuse. This is the view of Hertzler and others, though McCarrison would argue that the types are entirely different and occur in different circumstances. My experience tends to support Hertzler's view, for one finds that in simple goitres with a short history of from a few months up to a few years, the thyroid swelling is nearly always diffuse. In simple goitres, however, which have been present for ten to fifteen years or more, the swelling usually has been nodular. The diffuse glands behave to stimuli in a particular way. They enlarge with an infective illness, during menstruation or during pregnancy and with repeated pregnancies a step-like increase in size is found. Remove part of the diffuse gland by surgical operation and the other half usually hypertrophies. The nodular glands, on the other hand, do not seem subject to these variations, possibly because fibrosis has developed by the time this stage is reached.

The recognition of these two types is, I think, important in considering the question of iodine treatment of simple goitre. Therapeutically, iodine appears to have little effect on the nodular gland, and I think most clinicians would agree that there is no known form of medical treatment which can be expected to reduce the size of these glands. In a patient who has a nodular goitre, iodine may be useful as a prophylactic measure and may prevent further enlargement, but it needs to be given with caution in view of the possibility of an excess producing thyrotoxic symptoms. I have seldom met with this in my own experience, but it is a possibility which is frequently mentioned in the literature. In the later stages these nodular glands are usually associated with hypothyroidism and treatment with thyroid extract can be instituted, though it also needs giving with caution and should be stopped in the presence of active infection or toxic symptoms may supervene. In the treatment of the diffuse colloid goitres I think iodine is of value in the very early stages. A goitre of this type which has only been present for six months or so may quite probably disappear with iodine therapy. This result, however, is not likely to be obtained in a simple goitre which has been present for more than one or two years, though iodine should be given from time to time in such cases to prevent further hypertrophy. The early recognition of such thyroid swellings at puberty, pregnancy and lactation is important, and should lead to the institution of iodine therapy.

Although iodine is not of great value as a therapeutic measure when a simple goitre has once developed, nearly all authorities would be agreed that iodine prophylaxis in endemic areas is invaluable. There are many records now to show that the introduction of iodine prophylaxis in goitrous areas has resulted in a

great diminution in the incidence of endemic goitre. Perhaps I may mention one example only. In an investigation in 1917 in the school population of Akron, Ohio, amongst 2,190 girls who were prophylactically treated for three years only five developed goitre as against 495 cases amongst 2,305 who were not. Similar results have been obtained in other endemic areas. The problem has recently been considered by the Berne Conference, where it was agreed that iodine prophylaxis in endemic areas is most important. It was also advised that goitres detected in the course of school inspection should be treated with iodine.

Iodine as a therapeutic measure in Graves' disease.—I think it will simplify the discussion this afternoon if we adopt the terms primary and secondary Graves' disease instead of exophthalmic goitre and toxic adenoma, as these terms now appear to have come into more or less general use amongst clinical workers in this country. The primary Graves' disease syndrome is represented by the typical picture of exophthalmic goitre in which the goitre, exophthalmos and thyrotoxic symptoms develop at or about the same time. In secondary Graves' disease, on the other hand, thyrotoxic symptoms develop after some years in an existing simple goitre. The distinction between the two syndromes is an important one from the point of view of our present discussion.

(*a*) Iodine treatment as a therapeutic measure in primary Graves' disease.—Professor Harington has alluded to the historical aspect of this subject. Until the beginning of the present century the majority of clinical physicians would have regarded iodine as contra-indicated in the treatment of Graves' disease. Then by chance Trousseau obtained proof of its beneficial effects. The story is told that he was called upon to treat a patient with typical exophthalmic goitre, prescribed iodine by accident instead of digitalis and was astonished when he discovered the mistake a fortnight later to find that his patient had improved out of all recognition and was high in praise of this most satisfactory treatment. Subsequently iodine became recognized as a valuable measure in Graves' disease but fell into disrepute when Kocher pointed out that colloid goitres with indurated nodules might become thyrotoxic after iodine. It was later shown that iodine was beneficial in exophthalmic goitre, i.e., the primary Graves' disease syndrome. In 1923 Plummer published his statistics and views to the effect that it not only produced immediate results but was also beneficial in the crises of this disease and in the prevention of post-operative accidents. This work has been repeatedly confirmed by others since. Now the majority of physicians would agree that iodine does produce striking immediate benefit in primary Graves' disease, though the majority would probably hold the view that the favourable effects are only transient. It has been pointed out, for instance, that if the drug is given continuously in the same dose as the initial one its effects pass off, whilst a second course does not have the same effect as the first and a third is usually ineffective. This is not the universal view, for the Belgian workers, notably Dautrebande and Lemort, suggest that by modifying the mode of administration of iodine and augmenting the dosage from time to time they can get prolonged beneficial effects and control the thyrotoxæmia. They regard iodine as a valuable fundamental method of treatment. In their patients repeated estimations of the basal metabolism were carried out and every time it rose the dosage of iodine was increased. They report a fall in the basal metabolic rate at each augmentation of the dose in 76% of cases. With the fall in metabolism they describe an improvement in the clinical signs. In their paper they mention patients under observation and treatment by this method for as long as three years. In these patients they say that they hope it will not be necessary to operate, a method of expression which rather suggests to my mind that the thyrotoxæmia had not been entirely controlled. The majority of clinicians in this country would be less optimistic as to the value of iodine as a routine measure, though several have

expressed the opinion that if it is given the disease runs its course at a somewhat lower level of intoxication. This is the view which would fit in best with my experience. With medical treatment alone, however, and especially with iodine, there always appears to be a tendency for primary Graves' disease to relapse on the least provocation, usually anxiety or some infective illness, and the results of medical treatment are not comparable to those obtained with operative measures. Unfortunately in certain cases mental and other considerations are so predominant that operation does not appear to be a justifiable risk.

We shall probably all agree as to the immediate beneficial effects of iodine in primary Graves' disease. There is usually a striking subjective and objective improvement during the first fortnight after iodine treatment has been instituted. The basal metabolic rate falls to a level often below the normal, the pulse-rate slows and the body-weight, previously declining, begins to rise. The most striking effects occur in the thyroid gland itself. Whereas before treatment the gland is usually soft, pulsating and vascular, judged by the bruit which one hears over it with a stethoscope, after a few days it hardens up and the vascularity is considerably diminished. Histological sections at this stage will show a return of colloid in the vesicles. This beneficial immediate reaction to iodine we should now generally agree is best taken advantage of as a preliminary to operative measures. Not all cases of primary Graves' disease respond immediately in this satisfactory way. The cases which benefit most are generally those with large previously uniodized vascular goitres. This is usually the type of gland in the younger patients. These glands appear to me to harden up to the maximum extent after iodization. In the older patients who develop primary Graves' disease, especially those about the time of the climacteric, the initial thyroid swelling uniodized is often small and fewer signs of vascularity can be detected. These glands do not seem to me to harden up in the same way nor is the immediate beneficial iodine remission quite so satisfactory.

(*b*) Iodine as a therapeutic measure in secondary Graves' disease.—Since Kocher pointed out, about thirty years ago, that colloid goitres with indurated nodules might become thyrotoxic after iodine administration, there has been a tendency to regard this preparation as contra-indicated in secondary Graves' disease. Plummer elaborated this view, and came to the conclusion that iodine had a bad influence in what he described as toxic adenoma, i.e., the type of secondary Graves' disease with nodular goitre. The Swiss authorities have also reported that they daily come into contact with cases of adenomatous goitre who show intolerance to iodine. Belgian workers, on the other hand, and notably Dautrebande, have recently suggested that in cases of so-called toxic adenoma in their country, a condition which is apparently identical with Plummer's toxic adenoma, iodine has a beneficial action. By repeated examinations of the basal metabolic rate in their cases, Dautrebande and Lemort have endeavoured to prove that the same method of augmented doses which they apply in primary Graves' disease exerts a beneficial effect also in the secondary type. They find that it never produces an increase in the basal metabolic rate or exaggerates the symptoms as compared with the initial state, and they suggest that, possibly, geographical considerations account for the difference in results.

It is my impression that the majority of physicians in England would support the views of Plummer and the Swiss authorities. I have recently reviewed a series of cases of secondary Graves' disease of my own. They fall into two types, those with diffuse colloid goitres and those with the nodular type of gland. There are 105 cases, 102 in females and three in males. In 66 the goitre was of the diffuse type, in 39 of the nodular. One must recognize, of course, that the division into "diffuse" and "nodular" is a somewhat arbitrary one, as the presence of nodules in a gland depends to some extent on the personal equation in the examining physician.

Perhaps I have erred in the direction of only including in the nodular group those cases with well-marked nodularity.

There are one or two points about this series which I may mention before passing to the question of iodine treatment as they will give a better understanding as to the nature of the cases. First, it is highly interesting to find that in 64% of the diffuse group and 68% of the nodular, the initial simple goitre developed during the puberty and maximum growth period. In the majority of both groups, therefore, the subsequent thyrotoxæmia developed in a gland which would have originally been regarded as a simple puberty goitre. This, to my mind, is an important consideration, and points to the advisability of prophylactic treatment in all simple puberty goitres. The next interesting fact about these cases is that in 87% of the diffuse group secondary thyrotoxæmia developed within a fifteen-year period after the onset of the simple goitre, whilst in 68% of the nodular group this period was over fifteen years. The diffuse glands were found in the younger patients, the nodular in the older. These observations might be taken to point to the fact that the nodular glands are probably a later stage of the diffuse, though of course one could only confirm this by following individual cases through their life-history. The factors apparently responsible for the onset of secondary thyrotoxæmia as far as they could be elicited were as follows: In 35% some infection, in 33% some psychological shock or anxiety, in 7% the administration of thyroid extract, whilst in 17% no cause could be elicited. These data give some idea as to the cases under consideration. I imagine that the nodular group in my series correspond to the adenomatous goitres mentioned by Professor Harington, the "toxic adenomata" of Plummer. That secondary thyrotoxæmia occurs so often in the diffuse type of gland is not, I fancy, very widely recognized. In an experience at a London hospital the number of such cases is impressive. The criteria of thyrotoxæmia have been an increased metabolic rate or, clinically, pronounced cardiovascular disturbance, especially tachycardia, with some loss of weight, though the latter is seldom so great as is seen in the typical case of primary Graves' disease.

Of the effect of iodine in these cases it is extremely difficult to speak with any certainty, for other factors—rest, removal of septic foci, and so on—have played an important part in their treatment. I will endeavour, however, to give my general impression of the value of iodine. Nearly all the diffuse cases in my series have been treated with iodine, though I do not think that by this means the condition has been controlled. There were, however, no cases in this group in which iodine produced an exacerbation of symptoms. The latter usually resulted from some temporary infective illness. Increased dosage of iodine may have influenced the relapse but it does not seem to have controlled it. Removal of a septic focus, when it is responsible for the condition, does appear to exert a most beneficial action on the symptoms, and iodine given subsequently generally produces a further improvement in the disease. It is, however, extraordinarily difficult to assess its value as one has no opportunity for control observations. The fact remains that we still treat most of these cases with iodine and believe that they do run a course at a lower level of intoxication than those which are not treated in this way. This diffuse group is an extremely difficult therapeutic problem, for they seem to be resistant to most forms of treatment. Surgical interference, in my experience, almost invariably results in a recurrent hypertrophy of any thyroid tissue which is left in spite of iodine treatment, whilst the symptoms usually continue unabated. Our present plan is to combine iodine therapy with periodic doses of X-rays, a method which has given more satisfactory results than any other.

As regards the effect of iodine in the nodular goitres of secondary Graves' disease, one is on surer ground in expressing an opinion. One has to give iodine to such patients with more caution, for though some may derive benefit,

in others there is a tendency to intolerance. In these cases the initial striking improvement found in primary Graves' disease with iodine is seen less often, but I would always try it and in fact do make a point of doing so as a pre-operative measure. Fortunately, this nodular type of secondary Graves' disease appears to respond satisfactorily to operative treatment, especially if the gland has reached a fibrotic stage when operation is undertaken. Then there does not seem to be the tendency to recurrent hypertrophy such as is found in the diffuse secondary toxic goitres.

It is my impression that the degree to which the gland hardens in Graves' disease is related to the degree of improvement clinically. I mention this in the hope that others will either be able to confirm or refute it. I would also like to consider a possible theoretical explanation of this observation: The most striking effect of iodine on the gland histologically in primary Graves' disease is to fill the depleted vesicles with colloid though the secreting tissue remains as before. The most striking effect of iodine on these glands macroscopically, is to harden them up sometimes to a most remarkable degree. The most striking effect of iodine on the gland surgically is to diminish vascularity. It is, I think, worthy of consideration as to how far these beneficial effects of iodine are due to purely mechanical causes—to distension of the vesicles with colloid, leading to pressure on surrounding blood-vessels and secreting tissue.

Mr. T. P. Dunhill said that the question of the extent to which iodine should be used in the general treatment of the disease was a somewhat vexed one. Many surgeons would restrict its use to the preparation of a patient for operation. There was much to be said for this view, as he would point out later, but the use of iodine should not be denied to physicians in the early stages of the disease, or in the treatment of a crisis. Physicians, however, should realize its limitations, and give consideration to what might be expected from it later, in preparation for operation. The patient in the early stages of the disease might possibly be restored to equilibrium by its use, combined with other appropriate measures, but it should not be persisted in if it failed to achieve the result expected from it. Speaking from the purely surgical point of view, it must be remembered that the exaggerated claims often made for iodine were not voiced by Dr. Plummer. His statement was that many patients were greatly benefited by it, others to a less extent, some no more than they could be by good hospital treatment, while a few were definitely made worse. Some surgeons, with more optimism than truth, had published the statement that with the use of iodine there was no longer any necessity for the ligation of arteries, or for operation to be carried out in stages. This was not his (the speaker's) experience. Many patients still came for operation who were desperately ill, and some of these failed to respond in the slightest degree to the administration of iodine. Possibly this was because it had already been given for a long period in large doses, and the capacity of the patient to respond to it had thus been lost. In such cases the operation remained a very grave one, and a subtotal thyroidectomy in one stage could not be made safe for patients who were so ill. He had lost two patients in the last two or three years even though he had begun by ligation of arteries, and had later dealt with one lobe at a time. These deaths might have been due to the misuse of iodine in the earlier stages of treatment. It was more than likely that they could have been operated upon without risk if the operation had been performed during that first response to iodine. It was when a surgeon had to deal with—and occasionally lose in spite of graded operations—these extremely ill patients, that he felt strongly about the indiscriminate administration of iodine in the earlier stages of the disease. The number of these severely ill patients was surprising. It would be thought from the claims made for medical treatment, elimination of sepsis, or X-ray treatment,

that they would become fewer and tend to disappear. On the contrary the numbers appeared to be increasing. Was this because of the lack of supervision in the employment of iodine, or simply because iodine had failed to control the disease? Physicians should surely bear these facts in mind.

With regard to the question raised by the two openers as to the value of iodine in nodular goitre with toxic symptoms: It had a definite value, but the amounts given should be less than in a case of primary toxic goitre. He (Mr. Dunhill) believed that the iodine required would be found to bear a relationship to the amount and condition of the functioning thyroid epithelium.

Section of Physical Medicine.

President—Sir ROBERT STANTON WOODS, M.D.

[*February* 17, 1933.]

Joint Manipulation (Upper Extremity).[1]

By JAMES MENNELL, M.D.

OUR profession may be blamed and abused because we have not in the past made use of the art of manipulation more freely in our ministrations to the public. But critics forget that one of the most important functions of a registered body of qualified medical practitioners is to shield the public from harm. No doubt many people in the past have had to abandon tennis or football because of minor injuries that might have been remedied by manipulation, but this is a relatively small price to have paid, if, by our caution, we have saved others from loss of limb and possibly of life.

If, however, we can offer a rational explanation of what we do when we mobilize a joint, then the treatment rests on a scientific basis, and the remedy, in skilled hands, becomes safe and free from the terrible abuse and risks that so often surround administration by unqualified hands.

If we are to be able to treat a patient scientifically, the first essential is accurate diagnosis, and if we are called upon to make a diagnosis of any joint lesions, we must in the first place study the movements of joints. Unfortunately the knowledge to be gained from the ordinary anatomy text-book is altogether inadequate when we are asked to form a diagnosis of a joint lesion. From this source, for example, we learn nothing as to the movements which can be performed at joints and which are normally not under voluntary control. Yet it is, often enough, the examination of these movements that reveals the nature of the lesion within the joint, and thus points the road to cure.

Movements of the metacarpo-phalangeal joints.—These offer an admirable study in this respect. The movements of flexion and extension are not hinge movements, for the base of the phalanx glides over and round the head of the metacarpal (fig. 1, Plate I). It will be found that throughout the movement one point on the metacarpal is always equidistant from one point on the phalanx, and these two points must of necessity be represented by the attachments of the lateral ligaments. With the metacarpal attachment as centre and the ligaments as radius, the points of attachment of the ligaments to the phalanx describe a circle. The ligaments are not equally taut throughout the whole range. That this is so is shown by the study of those movements that are not under voluntary control.

The first law of all osteopathic and bone-setting manipulations is, whenever possible, to apply tension. This we are free to do with all the force in our power, but only if we pull in the long axis of the fibres of the lateral ligaments while using the "golf-club grip." Comparatively little force is safe if applied with leverage, or at an angle to the line of the fibres in the ligament; very little will strain them.

As a result of tension on a normal finger it is possible to pull the joint surfaces apart (fig. 2). Any loss of elasticity in the ligaments can thus be tested, or adhesions within them can then be broken down.

A second movement which is not under voluntary control is the antero-posterior movement of the phalanx on the metacarpal (fig. 3, Plate II). This has nothing to do with flexion and extension, it is a pure antero-posterior movement. Again there is no leverage, and so the movement can be performed with vigour.

Rotation of the phalanx on the metacarpal is again not under voluntary control, and is performed by bending the distal part of the digit into a hook, and rotating the proximal bone in both directions. Now we are using leverage, so that far greater caution is needed.

[1] The figures used to illustrate this paper are taken from the author's "Massage: its principles and practice," 3rd edition, and are reproduced by courtesy of the publishers, Messrs. J. and A. Churchill.

Side-bending of the phalanx on the metacarpal has nothing to do with adduction or abduction. In these movements, again, the base of the phalanx slides from side to side over the top of the metacarpal head—a movement which is quite free in extension but which becomes more and more limited as flexion increases. If the lateral ligaments were taut in extension, abduction and adduction must be impossible. This physiological fact has immense bearing on the pathology of the joint, as it can only indicate that the lateral ligaments are lax in full extension, but become taut as flexion increases. We now see the great danger of forcing flexion injudiciously, since, if, when the finger is straight, the lateral ligaments have lost elasticity or have become stiffened in any way, they must offer gross impediment to movement when we try to flex. If, then, we force flexion with leverage we are liable to strain them severely, and to do more damage in this way than we can hope to do good by securing the movement. Therefore the object in view when we perform the side-bending movement is to stretch the lateral ligaments to the uttermost (fig. 4, Plate III), but now we are again using considerable leverage, so that caution is necessary.

This is the last movement that is not under voluntary control, and we are now at liberty to proceed to flexion and extension.

Here again, if there is impediment to movement we must avoid undue leverage, and also we must perform the movements only in conformity with the physiological movement of the joint. We saw that, during normal movement, the base of the phalanx slides round the head of the metacarpal—it does not bend as if on a hinge. Therefore, if we push the base of the phalanx forward with one thumb, while the other presses the head of the metacarpal backwards, the base of the phalanx must swing round the head of the metacarpal and flexion will be performed (fig. 5, Plate III). The pressure is reversed for securing extension. With the force exerted in this manner, leverage is reduced to a vanishing point—provided the thumb pressing on the base of the phalanx does not slip up the shaft. Therefore force may be exercised freely and in safety.

Movements of the phalanges.—The metacarpo-phalangeal joints and the inter-phalangeal joints are all more or less identical, and all that has been said of the metacarpo-phalangeal joints applies, though naturally in smaller degree, to the inter-phalangeal.

Movements of the inter-metacarpal joints.—The joints at the bases of the metacarpals must be loosened if voluntary flexion and extension of the metacarpo-phalangeal joints are to be performed with freedom and comfort. Rotation of the fifth metacarpal backwards assists the power of extension of the metacarpo-phalangeal joint, and rotation forward assists flexion. Therefore it behoves us to free the joints between the bases of the metacarpals. This is not a plain antero-posterior movement, rather is it a semicircular movement of the shaft of a metacarpal round the next one. This movement must be secured so that on full flexion of each digit by itself, the long axis of the distal phalanx always points to the same spot—the tubercle of the scaphoid—whether we are dealing with the second or the fifth.

The moral is that, if we wish to apply tension with tapes, or if we are treating a fracture of a phalanx in flexion, unless the fixation point is over the tubercle of the scaphoid, disaster will follow. Either the lateral ligaments on the one side of the metacarpo-phalangeal joint will be strained, or the bone, when extended, will have a very nasty angulation.

There is one other point about the movement of the first metacarpal. It is not sufficient to mobilize the base of the bone on the carpus, but it is necessary to free the trapezium as well.

Vacuum snaps of the capsule.—The snapping noise often heard on manipulation of a joint is dear to the heart of the unqualified practitioner. This noise he

PLATE I.

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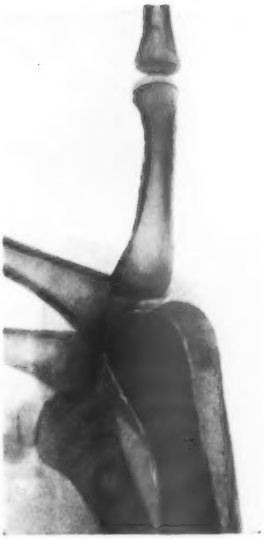

FIG. 1*a*.

FIG. 1*b*.

FIG. 1.—To show the manner in which the base of the phalanx glides round the head of the metacarpal during normal voluntary flexion. (*a*) Shows extension, (*b*) shows flexion. Note that the distal end of the metacarpal in (*a*) is covered by the base of the phalanx; in (*b*) the phalanx rests upon the anterior surface.

FIG. 2*a*.

FIG. 2*b*.

FIG. 2.—To show the result of tension on a phalanx in its long axis. In (*a*) no tension is applied, and a narrow space is seen between metacarpal and phalanx. In (*b*) the tension has been applied and the space between the bones widens materially.

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PLATE II.

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FIG. 3*a*.

FIG. 3*b*.[1]

FIG. 3.—To show the range of antero-posterior mobility of the base of the phalanx on the head of the metacarpal. In (*a*) the phalanx is moved backwards, in (*b*) it is moved forward. (The change in general position is due to the difficulties of securing a clear photograph.)

[1] The films from which figures 3*b*, 12*b* and 13*b* were taken have been inadvertently reversed. Each of these illustrations is of the same joint as that shown in the corresponding figures (3*a*, 12*a* and 13*a* respectively) and not of the joint on the opposite side.

PLATE III.

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FIG. 4*a*.

FIG. 4*b*.

FIG. 4.—To show the effect of lateral bending of the phalanx on a metacarpal. (*a*) Shows radial, and (*b*) ulnar deviation. Note the wide gap on the side of the joint away from which the phalanx is bent.

FIG. 5*a*.

FIG. 5*b*.

FIG. 5.—To show how the phalanx flexes automatically if the base of the phalanx is merely pressed forwards on the head of the metacarpal. The model was resisting the movement to the fullest possible extent.

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FIG. 6*a*.

FIG. 6*b*.

FIG. 6*c*.

FIG. 6.—To show the joint movements that take place while palmar-flexing and dorsi-flexing the hand. (*a*) Shows the position in acute palmar flexion, (*b*) in the mid-position, (*c*) in acute dorsi-flexion. Note that although the semilunar does revolve upon the lower end of the radius, the os magnum does so on the semilunar certainly to no lesser extent.

JAMES MENNELL : Joint Manipulation (Upper Extremity).

attributes to the slipping back into place of "the small bone," the cartilage, the tendon or the nerve. The only physiological explanation possible is that the noise is caused by the snap of the capsule in response to suction exercised by a vacuum.

Movements of the wrist region.—When we raise the hand backwards we are accustomed to say that we dorsi-flex the wrist; when we move it in the opposite way we say that we palmar-flex it. We thus lose sight of the fact that the movement is really dorsi-flexion and palmar-flexion of the hand, and that only a part—perhaps a relatively smaller part—of the movement takes place at the radio-menisco-carpal joint, i.e., at the *true* wrist-joint, while the other part of the movement takes place at the transverse intercarpal joint (fig. 6, Plate IV). Therefore it behoves us to study the movement of this joint and to note the anatomical contour. It is sinuous in outline, and yet so made that movement is free through a wide range. This is best seen by noting the movement of the os magnum on the semilunar, while using a fluorescent screen.

Now, supposing that some outside force is acting strongly during the movement of this joint, or supposing that some sudden strain is exerted while the muscles are off guard, would it be surprising that some unnatural movement should take place? If so, might it not very easily happen that forced eccentric movement should drive one of the cartilaginous surfaces against another with a force sufficient to cause it to pass the true limit of anatomical movement? If so, what more natural result could we expect than that these surfaces should jam and lock upon one another—or, to use an engineering expression, "seize up" on one another? Types of accidents which we can well imagine might cause an injury of this type are things such as a false shot at golf or tennis.

This indeed often happens, and it is clear that relief depends on one thing only—the release of the lock. Manipulation of the joint alone can effect this. Until this truth is realized by the whole of our profession, these injuries will remain uncured; until, in despair, the victim visits a bone-setter and secures instant relief, to the everlasting discredit of the medical man. But in performing the manipulation let us remember that it is useless to mobilize the wrist-joint if the transverse intercarpal joint is at fault. To force the hand through the full range of movement while the transverse intercarpal joint is locked, will only add fuel to the fire by straining the true wrist-joint.

To free the movement of the distal row of carpal bones on the proximal we first apply tension. The fore-arm is placed in the mid-position of pronation, and a grip is taken by the thumb and first finger at the base of the carpus. The fingers that grip are held rigidly, they must not pinch. The elbow is then flexed to a right angle and counter-pressure is placed upon the front of the upper arm with the other hand. The two hands are then pulled apart with all the power possible. Often this will prove to be enough to free the locking, and indeed this simple manœuvre is one example of the so-called "miracle cure" of the bone-setter in cases of golf and tennis wrists.

This dragging of the joint surfaces apart is a movement which is not under voluntary control, but there is still another which we must examine, and try to free, if necessary. This is the antero-posterior movement of the hand on the fore-arm. It has nothing to do with flexion and extension, and takes place mainly at the mid-carpal joint (fig. 7, Plate V).

The antero-posterior movement of the proximal row of carpal bones at the true wrist-joint—the radio-menisco-carpal joint—is a much more limited movement, and the sensation conveyed to the examining hand and to the patient is entirely different. The two thumbs are slid over the lower end of the radius till the joint line is felt. Then the proximal row of carpal bones is grasped firmly between the thumbs and the two first fingers, which are placed on the palmar aspect. The objective is to move the proximal row of carpal bones first towards the palmar

aspect of the radius and then towards the dorsal aspect. The difficulty is to realize how relatively small is the range of movement, and to avoid attempting to pass the anatomical limit. If we do so we shall merely perform dorsi-flexion and palmar-flexion of the hand, which is useless from our present point of view (fig. 8, Plate VI).

The carpal bones themselves form an arch, which can, to a slight degree, be increased and diminished. These movements are not under voluntary control, and the arching is performed by pinching together the horns formed by the extremities of the arch. The flattening of the arch must depend on pulling them apart again while exerting counter-pressure on the middle of the dorsum of the convexity.

There now remain only the joints on the two sides of the meniscus, between it and the head of the ulna on the one side and the carpus on the other. The manipulation is not an easy one. The index finger is curled into a hook that grasps the pisiform, the thumb is placed over the dorsum of the shaft of the ulna just above the head. The fore-arm is in the mid-position of rotation. The movement is performed by pulling directly backwards with the finger while pushing forward with the thumb. There must be no tendency for finger and thumb to close on one another. This will account for the movement of the meniscus backwards on the ulna, but we must also push it forward. To do this, the thumb of the other hand is placed on the back of the meniscus while the fingers grasp the radial side of the fore-arm. But, in the movement the meniscus was carried back with the carpus; and, therefore, to free the joint between the meniscus and the carpus, we must counter the first movement by the second throughout the whole range of the first movement. The difficulty is to avoid transforming the movement into either one of flexion or extension of the hand, or into one of mere rotation. There are other methods of securing the movements of all these joints, but for the sake of simplicity these are omitted.

A fairly wide range of rotation of the hand on the fore-arm is possible, and in this I believe the mid-carpal and intercarpal joints play only a small part. Most of it takes place in the true wrist-joint. The same applies to the first of the movements which we perform, and which is under voluntary control, namely radial and ulnar deviation of the hand. Finally we come to true palmar-flexion and dorsi-flexion of the hand—the combined movements of many joints, which should never be forced until all the other movements have been freed. If it has proved impossible to free those movements, then it is very unwise to attempt to secure the full range of physiological movement unless it is intended to fix the hand in full dorsi-flexion in plaster of Paris.

Movements of the radio-ulnar joints.—The question now arises: Is there, or is there not, any degree of mobility of the radius on the ulna in a longtitudinal direction? I believe there is and it is shown in the next two pictures (fig. 9, Plate VII). The difficulty, from a radiographic point of view, is that in order to pull the radius down on the ulna, tension can only be applied with the hand in the straight line; while, to push it up again, the hand must be acutely dorsi-flexed. Still the result is good enough to prove the reality of the movement.

I showed that tension exerted on the lateral ligaments of the metacarpo-phalangeal joints varied with the degree of flexion. The same holds good of the inferior radio-ulnar ligaments during normal pronation and supination of the fore-arm. There is, or should be, a wide range of free antero-posterior movement of the head of the ulna on the radius in the mid-position of pronation, but in full supination and in full pronation it is altogether lacking (fig. 10, Plate VIII).

In other words, in full pronation and supination the inferior radio-ulnar ligaments are at full stretch; in the mid-position they are not. Now let us consider for a moment the other bony attachments of the radius, and we find that it is not attached at all to the humerus: in fact, during normal movement, the head of the radius is only in contact with the lower end of the humerus in full extension and in full flexion

PLATE V.

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FIG. 7*a*.

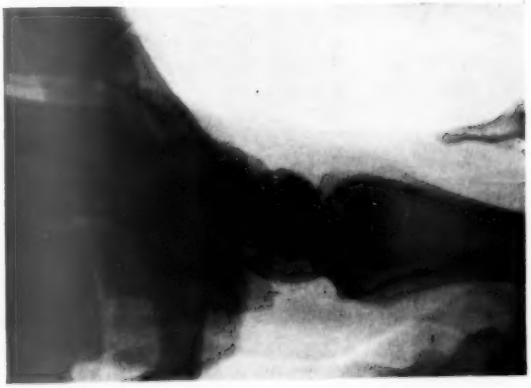

FIG. 7*b*

FIG. 7.—To show the antero-posterior movement of the hand upon the forearm. (*a*) Shows the movement towards the palmar aspect, and (*b*) towards the dorsal aspect. Note the relatively wide range of movement of the os magnum on the semilunar when compared with that of the semilunar on the radius.

PLATE VI.

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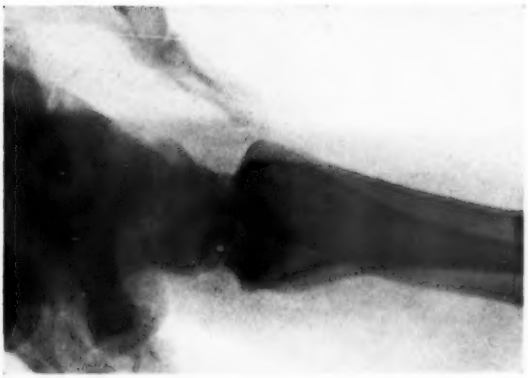

FIG. 8*a*.

FIG. 8*b*.

FIG. 8.—To show the antero-posterior movement of the proximal row of carpal bones upon the radius. (*a*) Shows the movement to the palmar aspect, (*b*) that to the dorsal. Note the very small range of movement when compared with the corresponding movement in the mid-carpal joint shown in fig. 7.

PLATE VII.

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FIG. 9*a*.

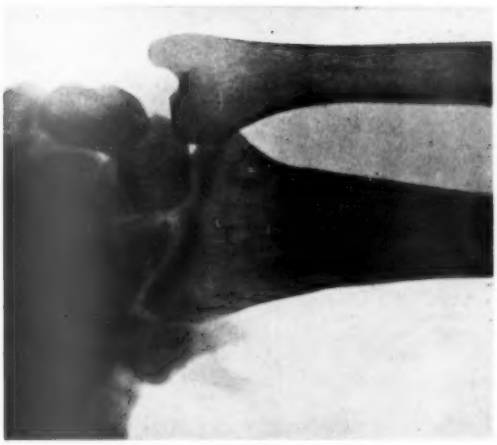

FIG. 9*b*.

FIG. 9. —To show the range of movement of the radius upon the ulna in a longitudinal direction. In (*a*) tension is applied to the carpus, the hand being in the same straight line as the forearm; in (*b*) the hand is in acute dorsiflexion and pressure upwards is being applied upon the hand.

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FIG. 10*a*.

FIG. 10*b*.

FIG. 10.—To show the antero-posterior movement of the head of the ulnar on the radius with the forearm in mid-pronation. (*a*) Shows the ulna in the forward position, (*b*) shows it in the backward position.

JAMES MENNELL: Joint Manipulation (Upper Extremity).

of the elbow. Therefore throughout the rest of the range of elbow movement there is nothing to prevent the head of the radius from being pushed up through the orbicular ligament towards the humerus, or pulled down into the ligament, except the interosseous membrane and the ligaments of the inferior radio-ulnar joint (fig. 11).

Conclusive evidence has been given that, while the lower end of the radius is rotating round the head of the ulna, the inferior ligaments that bind the two bones together are not taut, whereas they become so at the extremes of fore-arm rotation. The same play must be allowed by the interosseous membrane or the movement would be impossible. Therefore it is plain that, in the mid-position of pronation, there is nothing to bind the two bones rigidly together, and therefore it must be possible to pull the radius down on the ulna until these ligaments, becoming taut, pull the two bones firmly together. This means that the head of the radius, which usually lies free on the proximal side of the orbicular ligament, is pulled down into it, and this ligament is then strained downwards till it nips round the radius. Surely this is the only possible explanation of the condition we call the "pulled elbow", and, if the pathology of the lesion were only recognized more freely, we should apply the only rational treatment. The injury is caused by pulling the ulna down on the radius till it locks there; the obvious treatment is to push it up again. To do this all three radii—two of the operator and that of the patient—are placed in one straight line, the operator's wrists being fully dorsi-flexed, one hand grasping the dorsi-flexed hand of the patient, the other pressing on the back of his humerus. The two mobilizing hands are then pushed together while the patient's fore-arm is rotated slightly. Another of the so-called "miracle cures" is the result; movement is restored and pain ceases instantly.

But although we all recognize the condition called the "pulled elbow"—even if perhaps the pathology of the lesion is not widely recognized, and indeed, so far as I know, it has not been described in this way before—the corresponding injury, the "pushed elbow," is just as real an entity and far more common. Indeed it is liable to follow, and often does so, any fall on the outstretched hand if the fore-arm is in the mid-position of rotation and the elbow flexed. The head of the radius is driven up through the orbicular ligament as far as the inferior radio-ulnar ligaments will allow. Then, on attempting to straighten the elbow or to flex it completely, a few degrees of movement will be found lacking and pain is felt. Rotation of the fore-arm is also hindered, and is painful at the extremes of movement either way. All intermediate movement is free and painless.

If the treatment of the "pulled" elbow is to push, so too, the treatment of the "pushed" elbow is to pull, as already described when speaking of the carpal joints. In this way many a painful elbow and many a painful "wrist," as the patient calls it (not being able to discriminate between pain in the inferior radio-ulnar joint and the wrist), have been cured instantly, and will continue to be cured by the unqualified "bone-setters," until medical men will do this most simple of all manipulations for themselves.

Movements of the elbow.—As far as manipulation of the elbow is concerned, one cause of disability and its cure has already been described. For the rest, there is only one manipulation of the humero-ulnar joint which we can perform and which is not under voluntary control. This is performed by moving the shaft of the ulna laterally, from side to side; and, as the olecranon is situated above the attachment of the main lateral ligaments, it follows that if we adduct the shaft, we abduct the olecranon and *vice versâ* (fig. 11, Plate IX). In full extension this movement ceases to exist, so if we perform it in slight flexion and then slowly extend the elbow, the effect really amounts to grinding the olecranon into the olecranon fossa.

This movement is another which is often of service in the treatment of some cases of so-called "tennis elbow." As the result of a sudden extension while the muscles are "off guard," we can imagine a minute fold or fringe being nipped by the

beak of the olecranon as it jams home into the fossa. It becomes inflamed, then adherent, and every time the joint is fully extended it is further irritated. By the manœuvre just described it is presumably freed and pushed out of the way. Be this as it may, the value of the manipulation is undoubted.

The fact that lateral movement of the ulna is impossible in full extension, but possible with only a few degrees of flexion proves that the head of the radius is not firmly in contact with the lower end of the humerus once flexion of the elbow has commenced, though the bones seem to be in contact in full extension and full flexion. This being so it follows that, if the head of the radius has been pushed up to a relatively high position through the orbicular ligament while the elbow is bent, it will press on the under part of the humeral articular surface at an unduly early stage of extension, and this accounts for pain on extension. If therefore we wish to make certain that full supination has been performed, with full extension of the ulna, we must of necessity make sure that the carrying angle has been reduced to the uttermost. Thus in all manipulation in which we hope to regain the final degree of extension of the elbow, it is necessary to carry the fore-arm over into ulnar deviation as far as possible. Failure to do so is faulty technique, and often renders manipulation of the elbow-joints abortive.

To return to a matter of considerable controversy and one on which, personally, I hold very strong views: There seems to be a definite delusion abroad that, if we propose to move a stiff joint under anæsthesia the right thing to do is to move it through the full range of movement, regardless of the impediment to be overcome. I have tried to show that, when dealing with metacarpo-phalangeal joints, if movement cannot be secured by pushing the base of the phalanx either backwards or forwards, it is utterly wrong to use leverage in order to effect our aim. Better is it to know that we have failed, to wait, and to try again on a future occasion. So too with the elbow. The man who rashly endeavours to regain movement in the elbow by force is not only doomed to disappointment, but he stands a very good chance of damaging his patient severely. Therefore, if we encounter an elbow which is really very stiff, and we wish to free it by manipulation, the only safe course to pursue is to use short leverage and to cease the movement directly any definite impediment has been overcome. It is true that this may leave a great deal to be done on future occasions, but it is far better to err on the side of caution, and to do no harm, than to do more as far as restoring the movement is concerned, only to find that there is a severe reaction. This may well mean that when reaction has quieted down the patient will be far worse off than when we started. Therefore the only safe course when dealing with an elbow is to pass through the first dead point, and stop. Naturally if movement so carried out enables us to reach a point approximating to the full range, all is well and we shall secure the full range, the moment we have passed through the first dead point. Otherwise it is better to repeat manipulation than to do active harm. Unless we keep the carrying angle in mind all the time that the manipulation is performed, we may damage the joint severely.

Movements of the shoulder-joint.—Passing on to the movement of the shoulder and the manipulation of the joint, we encounter an anatomical difficulty. The thing which is most puzzling, when first considering the physiological movements which take place is:—why is the glenoid pear-shaped, while the humerus, which moves on it, is round? This fact can only mean that the movements of the shoulder-joint are not only those of a true ball-and-socket joint, like the hip-joint. Enlightenment on the pear-shaped contour can be gained, if we study the movement of a normal shoulder with the arm hanging by the side. If we pass our fingers over the edge of the acromion, where it overhangs the joint, we find that the head of the humerus protrudes in front of the acromion to a very marked extent. The same applies if our fingers drop downwards over the outer edge. In both positions the

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FIG. 11*a*.

FIG. 11*b*.

FIG. 11.—To show the lateral movement of the olecranon on the humerus as the result of increasing and decreasing the carrying angle when the elbow is slightly flexed. In (*a*) the forearm is carried to the radial side, in (*b*) to the ulnar side. Note also the difference in spacing in the radial-humeral joints, in (*a*) the joint-space is narrow, in (*b*) much wider. This proves that, when normal flexion has once started, the head of the radius is not in close contact with the humerus.

PLATE X.

FIG. 12*a*.

FIG. 12*b*.[1]

[1] See footnote to fig. 3*b*.

FIG. 12.—To show how the upper end of the humerus sinks downwards during abduction of the arm, so as to allow the movement to take place without nipping the soft structures between the upper end of the humerus and the acromion. It proved impossible to show the glide backwards as well as downwards during forward flexion, so for this we must rely on clinical observation.

downwards during forward flexion, so for this we must rely on clinical observation.

PLATE XI.

FIG. 13*a*.

FIG. 13*b*.[1]

[1] See footnote to fig. 3*b*.

FIG. 13.—To show the extent to which the head of the humerus can be pulled away from the glenoid, proving that the ligaments play little part in maintaining the stability of the joint, until the extremes of movement are reached. Were they not so lax, freedom of movement in all directions would be impossible. (*a*) Shows the normal position, (*b*) that when force is applied to separate the two bones.

upper end of the humerus protrudes for a considerable distance. If now we raise the arm forward, or if we abduct it, when a given point is reached—I am not sure about the exact angle, but it is more or less when the arm has moved through forty-five degrees—the head suddenly disappears altogether below the acromion (fig. 12, Plate X).

The examination of any large number of stiff shoulders will soon show that the upper end of the humerus, instead of sinking downwards and backwards in the glenoid, merely impinges on the overhanging bone.

Thus, the examination of the normal joint, and of those that have lost mobility, leads to one inevitable conclusion, namely that the head of the humerus does glide on the surface of the glenoid, downwards in abduction, downwards and backwards in forward flexion. If it is not free to glide in this manner, it impinges on the acromion.

Surely here we have a guide as to the reason why reaction after the movement of a stiff shoulder under an anæsthetic is often such a disastrous failure. If the head of the bone is not free to glide down, or down and back, and if we now try to force movement, we may succeed—but only by using the under surface of the acromion as a fulcrum to assist us in levering the head downwards. If we do this, our patient pays the penalty, for it is inevitable that soft parts will be nipped severely between the two bones. An acute general bursitis is set up, and the result is disaster.

If then we wish to manipulate a stiff shoulder, our first business is to free the gliding movements of the head of the humerus in the glenoid. This can only be done by performing those movements that are not under voluntary control. The movements here described are all given recumbent. As usual the first is tension—tension applied from the wrist with the elbow fully extended, while exerting counter-pressure in the axilla. The anæsthetist must not pull the head to the opposite side while tension is applied, or the roots of the plexus may be stretched.

Then the head of the bone can be pulled away from the glenoid if we slightly abduct the arm, place one hand in the axilla to act as fulcrum, and then press the elbow to the side (fig. 13, Plate XI).

The next manipulation is to press the head of the humerus backwards in the glenoid. This can be done by direct pressure to a certain extent, but better still by pressing downwards on the front of the arm at a point about the level of the insertion of the deltoid, while raising the elbow forward with the other.

It is rarely necessary to push the head forward in the glenoid, if it is so, then the grips are reversed.

In some cases of painful shoulder it will be found that the head of the humerus has slipped downward in the glenoid till it rests on the margin of the glenoid. The result is equivalent to walking on an unreduced fracture-dislocation of the ankle-joint. It is a common cause of so-called "brachial neuritis" which follows loss of power in the deltoid. It may even ensue when the deltoid itself is intact, if the arm has hung suspended in a sling from the shoulder for any length of time without movement.

To push the head up in the glenoid is very simple, and again this sometimes ranks among the "miracle cures" of the "bone-setter." Relief is often dramatic. The elbow is flexed, and the olecranon is placed on the chest of the operator with one of his hands between the two. The other fixes the scapula and clavicle. Now he rests his whole weight on the hand that covers the olecranon and sways his body slightly to and fro, while pressing always in the long axis of the humerus.

In all these movements leverage is either absent, or of so small a dimension that there is no possible chance of doing harm to any normal structure. This does not apply, however, to the forced movement of the head downwards in the glenoid with leverage. It is only safe to allow a degree of abduction to about forty-five degrees. The arm is abducted and supported with one hand, while the other presses downwards and inwards rather above the level of the insertion of the deltoid. This is the mobilizing hand, the other must remain fixed. If we use the reverse movement, sooner or later we shall produce a subglenoid dislocation.

When it comes to performing those movements that are under voluntary control, if we believe that they are impossible, (or at least injudicious), if the head of the humerus is not free to glide down and back in the glenoid, it is plain that the first movement—contrary to the general teaching—is to free the back of the joint by adduction across the middle line of the body.

Then pressing the head firmly downwards, the arm may be abducted to forty-five degrees. One hand must be over the head of the humerus and must try to coax it under the acromion. If it fails to pass under it, it is better to repeat the movements that are not under voluntary control, and try again. Under no circumstances is it wise to force the movement if the top of the bone rides up against the acromion instead of gliding underneath it. Once it is underneath, the grip is changed. One hand grasps the inner side of the arm high up in the axilla, the other controls the axillary edge of the scapula. They are then separated from one another till impediment is overcome. The only thing that cannot be overcome in this way is the bony impediment offered by the acromion.

The freeing of forward flexion is identical, and the same precautions must be used; but now we must remember that, however free rotation may be when the arm hangs by the side, it is limited to zero when the arm rests beside the head. In this position the internal epicondyle must point directly forwards. This is the equivalent of a fair degree of internal rotation if the arm hangs by the side.

The next movement is one which, as Sir Robert Jones used to point out, is so often missed. The hand is lowered behind the neck to the neck-rest position, and then the elbow is pushed directly backwards to the anatomical limit. The hand should reach the back collar-stud.

The patient is then rolled on to his side and backward movement is performed. No special features of this movement need attention. But now we wish to complete internal rotation by raising the hand up the back as far as it will go. It is dangerous to try to force this movement unless a sufficient degree of backward flexion has already been recovered to allow it. Every inch that the hand moves up the back entails an increase of both internal rotation and of backward flexion. To try to secure an increase in either by forcing the other only leads to disaster.

Finally the patient is placed on his back once more and external rotation is performed. This is the most dangerous of all movements to free, as with the elbow bent to a right angle, the leverage exerted with a grasp near the wrist-joint is very great indeed.

A warning.—May I add a word of warning? Is it not true that the art of joint manipulation is no longer a question of just pushing or pulling a part through a movement? Is it not rather a highly specialized technique, based on the study of the physiology of joint movement? If so, has not the time arrived when the details of technique should be taught regularly as a routine part of the education of every medical student? For as surely as we fail to do so, we must inevitably drive patients by the thousand to the hands of the unqualified practitioner. The number that already go is a reproach to our profession, but what are they to do while there are so few medical men who have made the necessary study and gained an adequate technique? The blame is our own.

Postscript.—I hear that it was hinted after the meeting that I must have selected my model carefully in order to secure someone with joints showing so marked a range of mobility. This is not so: my choice of a model was purely accidental. Happening to be in the X-ray Department at St. Thomas's Hospital one morning, I asked Dr. G. Fildes whether he thought it would be possible to show the movements that take place at various joints during manipulation. He asked me to demonstrate some of these movements. There happened to be with me at the time one of my Massage Staff, Miss C. Lamb, on whom I demonstrated what I wished to show; and she subsequently gave up much leisure time to enable these photographs to be taken. I can confidently assert that a similar result could have been secured with 90% at least of the other members of the Massage Staff and Massage School. Thus the selection of the model was pure accident. The movements shown are only those of the ordinary anatomical limit in a young adult whose joints are healthy. In no way may they be regarded as anything other than normal movements.

Section of Laryngology.

President—MUSGRAVE WOODMAN, M.S.

[*February* 3, 1933.]

DISCUSSION ON MALIGNANT DISEASE OF THE ORO-PHARYNX, INCLUDING THE FAUCES.

G. Gordon-Taylor: For those tumours of the hypo-pharynx amenable to surgical removal the old-fashioned knife may still be useful, and its employment the most appropriate method of ablation [1, 2], partly by reason of the anatomical dissection required, and partly because of the possible need of plastic efforts at reconstruction of the alimentary tube; but the extirpation or sterilization of primary malignant neoplasms of the oro-pharynx and fauces no longer involves the employment of the scalpel, and the modes of attack are now confined to diathermy and the various forms of irradiation.

In this respect the surgery of the oro-pharynx is in keeping with that of the tongue and buccal cavity. With the exception, perhaps, of those extensive cancers of the cheek demanding the removal of wide areas of tissue, from skin to mucous membrane, and necessitating the use of variously fashioned cutaneous flaps to replace the resulting gap in the face, when the use of the ordinary scalpel may still be advisable, the knife and shears have disappeared from the armamentarium of the surgeon who deals with malignant disease of the oral cavity.

Some years ago the late W. S. Syme [3], of Glasgow, insisted that diathermy decreased in suitability as a means of destroying cancer according as the site of the disease descended from the anterior margin of the gum to the œsophagus. The cases of malignant disease of the mouth and throat most suitable for diathermy are therefore those of cancer of the tongue, the alveolo-lingual space, the upper jaw, palate, tonsil and fauces.

Though the use of diathermy in oral surgery was at one time criticized by Gwynne Williams [4], who found that the ultimate results, so far as recurrence is concerned, are not affected, and although the method has been stigmatized by other surgeons [5] as a "retrograde" step, there seems to be now a general agreement among those with most experience of cancer of the fauces that the results of cautery excision were indubitably better than those of the knife and forceps, and that a still further improvement in the operative results has followed the employment of diathermy.

It is of course true that the scalpel may still be wielded as a means of obtaining surgical access to the neighbourhood of the pharynx, tonsil, and base of the tongue, with a view to the more accurate insertion of radium needles or radon seeds, but even in this "surgery of access" it is more fashionable to make use of the endotherm knife in penetrating into that anatomical territory whence the neoplasm may best and most accurately be "barraged." Furthermore, in those cases in which it is considered desirable to extirpate the lymphatic glands and the potentially infected tissues of the neck, the prudent surgeon, especially if brought up in the dissecting room, will still make use of the knife. I am not myself convinced that in the matter of improving the end-results of block dissections of the neck for cancer of the mouth and pharynx the employment of the endotherm knife or the hypnotic use of buried radium needles or radon seeds in the neck has helped one iota.

A paper by Norman Patterson [6], in 1919, on the use of diathermy in malignant disease of the mouth and pharynx attracted my attention at a time when I was profoundly depressed with the late results of the knife-and-scissors operation. In this article the author described his experiences with this form of treatment since 1915, and a subsequent paper in 1923 [7, 8] made me still more envious of his results.

Although Patterson claims no priority in this method of treating cancer of the mouth in England, and others, such as Cumberbatch [8, 9], Douglas Harmer [8, 10] and Dan Mackenzie [8, 11] have all advocated it warmly, it was Patterson's work that introduced the method to my notice, and since 1920 I do not think that I have treated a growth of mouth or oro-pharynx with knife or scissors, but have regarded diathermy as the method of election in all first-class "operation risks," except where the histological structure of the tumour, the situation of the growth, etc., appear to indicate radiation as the more appropriate remedy.

NORMAN PATTERSON'S CASES [7]. (*British Medical Journal*, 1923.)

Epithelioma of tonsil, tongue and floor of mouth. Diathermy.	Symptom-free 8 years later.
Endothelioma of base of tongue, suspension, laryngoscopy, diathermy.	Symptom-free 6 years later.
Cancer of posterior part of tongue, anterior pillar of fauces, and tonsil. Diathermy. Gland infected and removed.	Symptom-free 5½ years later.
Carcinoma of right tonsil and palate.	Symptom-free 4½ years later.

In this series there are other cases of prolonged survival which do not come into the category of carcinoma of the oro-pharynx and other cases of shorter survival; doubtless the patients in some of the cases recorded by Norman Patterson in 1923 may have lived many years after that date, and assuredly he has, in the years that have passed, augmented the number of cases of prolonged survival after operation.

In carcinomatous growths of the pillars of the fauces, palate, tonsil, posterior wall of the pharynx, and even the base of the tongue, I submit that diathermy is an effective method of treatment: it often cures and at least it may sterilize the lesion for a number of years. In the earliest cases, where there are no palpable glands and where, from the situation and extent of the growth there is little likelihood of a secondary hæmorrhage of any severity, I am content to leave the neck alone: such cases are kept under close observation and in the event of any glandular enlargement the patient is at once submitted to a neck dissection. *I have not employed any post-operative radiation.*

I have quite a number of patients who have remained well without having this neck operation (figs. 1 and 2).

In a relatively small primary carcinomatous growth, with infected glands, or where the growth is of an infiltrative type, and from its position and its extent removal by diathermy is liable to be followed by a hæmorrhage of magnitude, the external carotid must be ligatured beforehand and the opportunity may be taken to deal with the lymphatic territory of the neck at the time, *even though the glands may not be clinically enlarged.* In a large experience of diathermy excision of carcinomatous tongues the operation has only twice been followed by a secondary hæmorrhage, and in each case the source of hæmorrhage was situated far forward and was easily controlled; I have, however, had one serious hæmorrhage after the removal of an infiltrating tonsillar growth where the external carotid had not been subjected to preliminary ligation.

In the more extensively infiltrating growths of the tonsil, where the base of the tongue is involved, or the side of the pharynx or the actual ramus of the jaw, some more thorough exposure is required than is obtained through the mouth itself, even if the angle of the mouth and cheek be split. In some of these cases the

FIG. 1.—Carcinoma of anterior pillar of fauces. Excision by diathermy, October, 1925. Recurrence treated by diathermy, June, 1926. No gland-dissection performed.

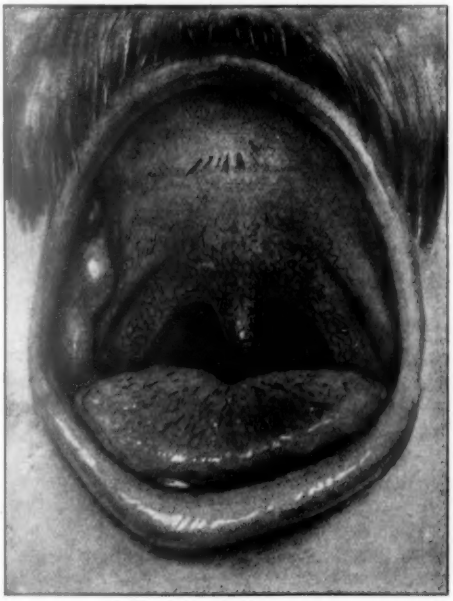

FIG. 2.—The same patient, February, 1933, showing freedom from recurrence nearly eight years after first operation.

removal of the alveolar border and upper half of the body of the jaw right back to the vertical ramus may facilitate the operative manipulation (see fig. 6, Plate II), but the only really adequate exposure is by removing that side of the mandible from the canine fossa right back to the condyle. This gives an excellent view of the deeper region to be dealt with (fig. 4, Plate I).

The neck operation precedes the destruction of the primary focus and the external carotid artery is ligated, and the neck cleared at the same time. If the sternomastoid can be left, its cut border, and the divided posterior belly of the digastric and stylohyoid can be wrapped round the vessels, shutting off the vascular sheath (fig. 5, Plate II), and I also fix in position a piece of sterile rubber-dam in order to afford a guide to the position of the vessels underneath and a protection when the jaw and growth are extirpated at the second operation. The neck is more thoroughly "coffer dammed" thereby and does not become grossly infected from the direct communication with the oral cavity.

Efforts at effecting a thorough extirpation of the glandular area of the neck are greatly hampered by any attempt to preserve the sternomastoid muscle, and although in cases of hypo-pharyngeal cancer I try to retain it, in cancer of the tongue I always remove it, and in faucial cancer I ablate it as a rule.

I yield to no one in my admiration of Wilfred Trotter, whose work on the pharynx is perhaps the finest British contribution ever made to the progress of surgery, but for growths at the base of the tongue, the pillars of the fauces, or the vallecula, I have never managed to obtain an adequate exposure by his operation of median trans-lingual pharyngotomy [12] [13], but the fault probably rests with myself and not with the method. The latter approach, however, may be advantageously utilized for the insertion of radium.

Extensive primary malignant disease of the tonsil and oro-pharynx may be cured

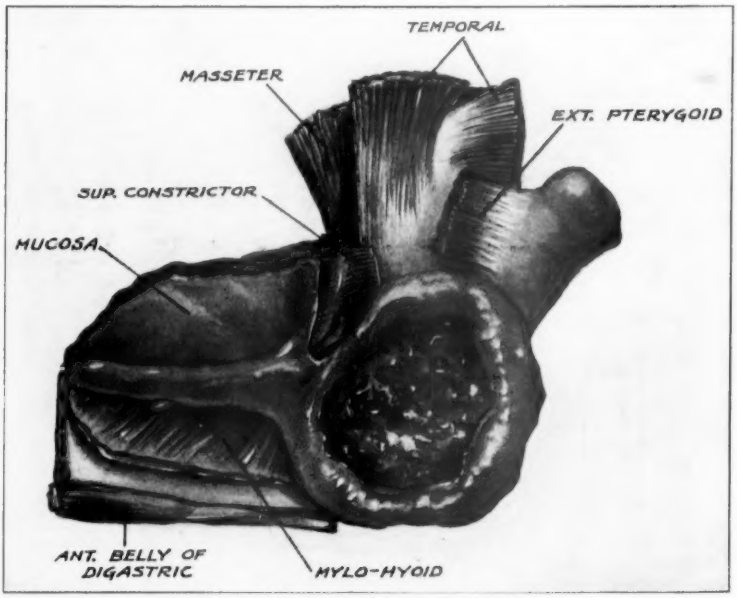

FIG. 7.—Infiltrative carcinoma of right tonsil treated by removal of mandible and extirpation of growth and jaw, en masse, March, 1923. Patient well, January, 1933.

PLATE I.

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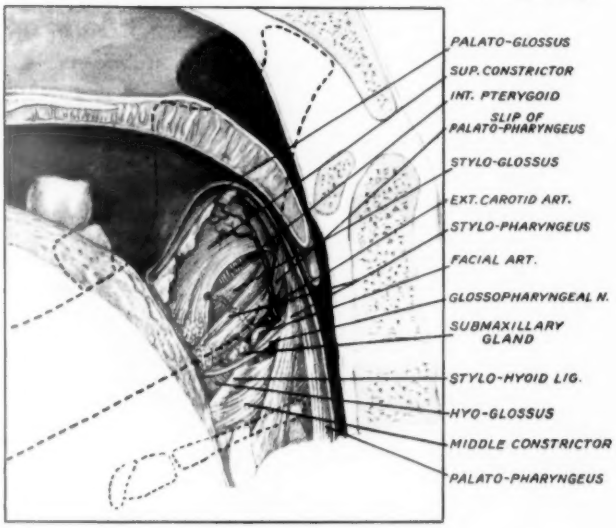

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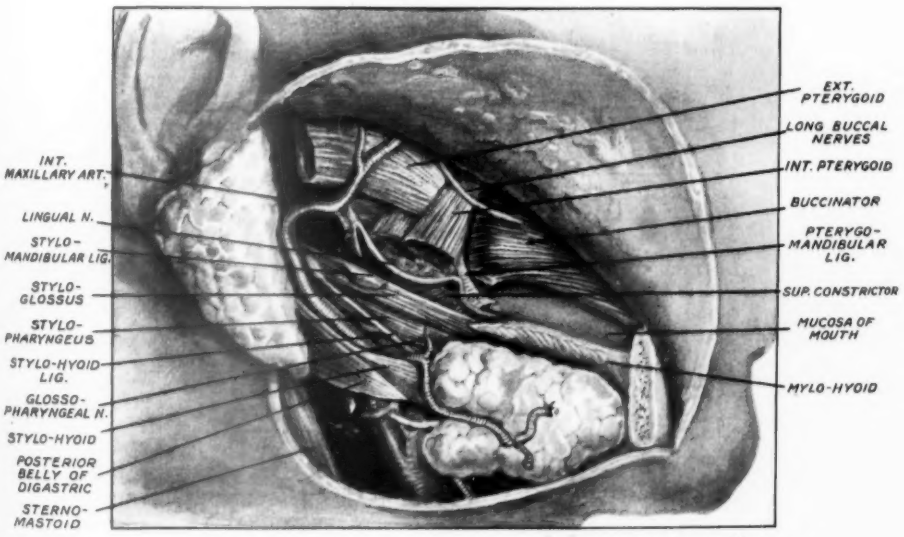
FIG. 3.—Dissection to show the relations of the tonsillar fossa, and the proximity of the facial and external carotid arteries.



4.

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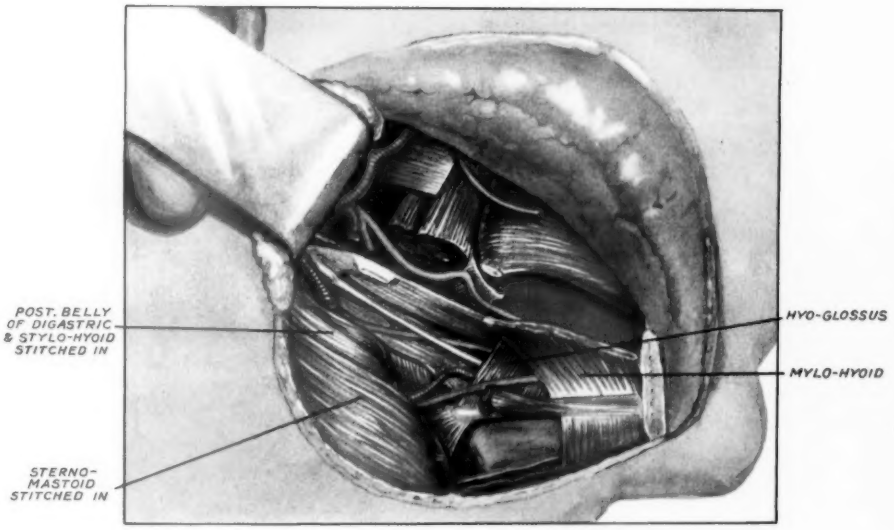
FIG. 4.—Dissection to demonstrate the external relations of the tonsillar fossa as displayed after removal of the mandible from the condyle to the canine fossa.

G. GORDON-TAYLOR: Discussion on Malignant Disease of the Oro-pharynx, including the Fauces.

UNIV. OF MICH.

PLATE II.

PROC. ROY. SOC. MED.
Vol. XXVI, No. 7.
Section of Laryngology.



5.

FIG. 5.—Dissection to demonstrate the structures involved in a diathermy excision of the tonsillar area from outside. The mandible and submaxillary salivary gland have been removed, and the vascular compartment is protected by turning the posterior belly of the digastric and the anterior border of the sterno-mastoid over the vessels.

6.

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FIG. 6.—Carcinoma of posterior part of tongue tracking forward along alveolo-lingual sulcus. Patient admitted with severe hæmorrhage which necessitated a blood transfusion and preliminary ligature of external carotid artery. Block dissection of neck. Glands infected. Tongue removed by diathermy. Patient alive and free from recurrence three and a half years later.

G. GORDON-TAYLOR: Discussion on Malignant Disease of the Oro-pharynx, including the Fauces.

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PLATE III.

PROC. ROY. SOC. MED.
Vol. XXVI, No. 7.
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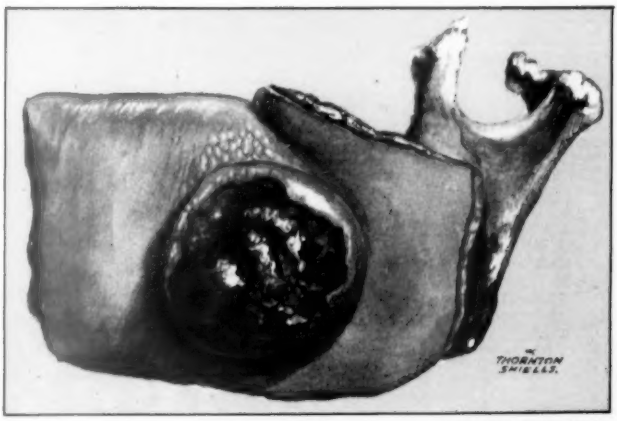
8.



8a.

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FIGS. 8 and 8a.—Carcinoma of posterior part of tongue involving mandible, alveolo-lingual sulcus and cheek. Patient alive and well nearly seven years after operation.

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by an operation which sacrifices half the jaw, even when glands are already infected (see fig. 7, p. 28; figs. 8, 8a, Plate III), but the results of radium therapy have made us look with an increasingly critical eye upon crudely mutilating operations, and before coming to decision as to choice of technique, the sex, the social environment, general condition, and physical conformation, must all be taken into account.

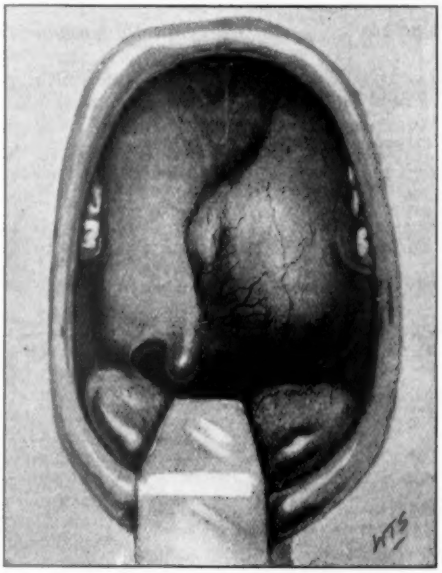

FIG. 9.—Malignant mixed tumour of palate removed by diathermy. Patient free from recurrence nearly seven years later.

FIG. 10.—Malignant mixed tumour of base of tongue removed by diathermy. Patient free from recurrence two and a half years later.

The mortality of the operation—from bronchopneumonia—is high, but good end-results persuade me that in some cases the operation is well worth doing. Dickie [14], of Middlesbrough, has employed it in a number of cases and speaks well of it.

When the diagnosis is in any doubt, a biopsy should certainly be performed. This is particularly to be desired in cases of malignant disease of the base of the tongue, and the vallecula, and in doubtful forms of tonsillar cancer. It must be borne in mind how badly these cases respond to extensive surgery, how mutilating is the operation, and on the other hand how radio-sensitive these cases are.

I have only one case of sarcoma of the base of the tongue which has survived any length of time—seven years—but a perusal of the results of radiation treatment convinces me that for sarcoma this form of treatment is the most likely to be successful.

If biopsy is to be made, it should only be performed after preliminary radiation for several days, and should be made with the endotherm knife.

Malignant mixed tumours are satisfactorily treated by diathermy excision (figs. 9 and 10). Douglas Harmer and Russell [15] recommend surgery and radiation; out of seven of their cases four have remained symptom-free for nine years.

SUMMARY OF DIATHERMY OF TUMOURS OF ORO-PHARYNX. (G. - T.).

Method of Treatment.

(*a*) Small growth on tonsil, palate, pillars of fauces or posterior wall of pharynx without glands (Group I cases).	Diathermy-excision, diathermy-coagulation or combination of both.
(*b*) Larger growths with risk of a severe hæmorrhage following diathermy, no palpable glands (Group II cases).	(1) Preliminary block dissection of neck and ligation of external carotid. (2) Diathermy.
(*c*) More extensive growths with or without glands (Group III).	(1) Block dissection and ligation of external carotid. (2) Removal of half jaw or part of mandible and diathermy.
(*d*) Doubtful tumours	Biopsy and appropriate line of treatment, diathermy, radium, X-rays.

My knowledge of the radiation treatment of malignant disease of the oro-pharynx is entirely second-hand. Till quite recently the results of radium therapy in the cases of which I have some knowledge have been most dismal, with the exception of cases of lymph-epitheliomata of the tonsil which have responded relatively well. (Windeyer). [16].

Cutler [17] writing in 1929 describes four encouraging results—symptom-free after eleven, nine, four and three years, and Berven [18] mentions five cases living free from symptoms for from two to five years. (75% of cases.)

An increasing body of evidence, European and Transatlantic, is now to hand, which demonstrates that good results can be obtained from radiation in malignant disease of the area under discussion.

DOUGLAS QUICK (NEW YORK) 1928 [19].

Of 318 cases of malignant tonsil 28 patients (8·7%) symptom-free for three years or more. Of these 28 survivors, 14 had lived over five years and 1 patient for ten years.

Method.—Prolonged external radiation with teleradium or heavily filtered high-voltage X-radiation—this suffices for embryonal types of growth. In the more differentiated epitheliomata in addition direct implantation of gold radon seeds into primary growth. Neck not treated by surgical dissection unless infected gland appears—then block dissection without post-operative radiation.

CARCINOMA OF TONSIL (J. DESPONS) [20].

Only from 5% to 10%, even if seen early, remain symptom-free at three years.

GORDON NEW, BRODERS AND CHILDREY (MAYO CLINIC) [21].

Tumours of base of tongue.

	Cases traced	Alive	Average number of years since operation	Dead	Time of survival
Lymphosarcoma ...	3	1	6½ years	2	One lived 4½ years.
Epithelioma (Grade IV)	7	4	3½ years	3	One lived 2 years.
Epithelioma (Grade III)	23	9	Over 4 years	14	Three lived nearly 4 years.

TUMOURS OF TONSIL.

	Cases traced	Alive	Average number of years since operation	Dead	Time of survival
Lymphosarcoma ...	9	5	Nearly 7 years	4	1 lived over 5 years
Epithelioma (Grade IV)	15	8	3½ years ...	7	None lived very long
Epithelioma (Grade III)	20	5	Nearly 5 years	15	Only 4 survived any length of time

H. COUTARD (PARIS) [22].

Advanced epithelioma of tonsil treated by X-ray.

Cases treated from 1921 to 1926 inclusive	Cases alive and symptom-free on January 1, 1931	Percentage
46 ...	... 12 ...	... 26
Cases treated in 1926	**Cases alive and symptom-free on January 1, 1931**	**Percentage**
13 ...	... 6 ...	... 46

Analysis of Coutard's cases of epithelioma of tonsil.

Year of treatment	Cases treated	Cases alive and well on January 1, 1931	Number of years survival
1921 ...	5 ...	2 ...	9
1922 ...	3 ...	1 ...	8
1923 ...	3 ...	0 ...	—
1924 ...	7 ...	1 ...	6
1925 ...	13 ...	1 ...	5
1926 ...	13 ...	6 ...	4

EPITHELIOMA OF TONSIL (BERVEN) [18].

Group I cases. 77% symptom-free at 1 year. 50% symptom-free at 3 years.
Group II cases. Percentage of cure gradually sinking to 50% at 3 years.

SARCOMA OF TONSIL (BERVEN) [18].

Group I cases. 77% healed after 1, 2, 3 and 5 years.
Group II cases. 75%—percentage sinking to 44% at 5 years.

The figures relating to the radiation treatment of cancer of the oro-pharynx fill me with hope of an end to mutilation and disfigurement in so far as the more advanced cases are concerned, but if I am travelling hopefully I can only journey slowly when I reflect on the dreadful results of radium therapy in the cases of cancer of the tongue with which I am personally familiar. Bad judgment, poor selection of cases, advanced disease, may all have been unfair to radiation, but the results of surgery are, in my hands, far better.

None the less, I find myself gradually and cautiously embracing the beliefs and opinions expressed by Douglas Harmer [23] in his Semon Lecture: "It is safer to treat the virulent types of cancer with rays than with surgery alone, and even early cancers may confidently be treated by irradiation *by experts*; there is reason to think

that external irradiation will be found to be necessary in nearly all cases before local treatment with radium, but it is not clear at present whether X-rays or large quantities of radium will produce the best effects."

I, myself, have made but one contribution to the radiation treatment of malignant disease and that an indirect one. In the autumn of 1918, near the ruins of a little village in Picardy, at Proyart-sur-Somme, I saved the life of a regimental medical officer attached to the Gloucesters. He had crawled out again and again from his trench to bring in wounded men, but a sniper finally shot him in the back. His cauda equina was badly damaged and he sustained severe abdominal injuries as well. His life was doubtless saved by my surgery and a transfusion of blood from a comrade. G. E. Birkett lived to do a great work for radium in Manchester before acute tuberculosis, alas, cut him off at an early age. If it was Norman Patterson's work that first showed me the possibilities of diathermy in malignant disease of the mouth and pharynx, it was Birkett of Manchester who revealed to me what radium could effect in skilled, competent, and enthusiastic hands.

The surgery of cancer of the oro-pharynx requires much judgment. In most surgical problems there is no single method of treatment applicable to every case, but that surgeon will get the best results who uses the most appropriate method for the particular case.

[The anatomical dissections illustrating this paper come from the Anatomical Department of the Middlesex Hospital; some were designedly prepared by Mr. Knights, the prosector, but in the operative surgery of this region as in so many surgical enterprises, I have been able to avail myself of the knowledge, skill and inspiration of Professor Thomas Yeates, whose enthusiasm is always a stimulus to the surgeon-anatomist, that vanishing race to which I am still proud to belong.

The illustrations are from the skilful brush and pen of my friend Mr. Thornton Shiells.]

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Norman Patterson: I do not propose to discuss the symptoms, diagnosis or treatment of tumours of a sarcomatous nature occurring in the oro-pharynx. Carcinoma is a comparatively rare disease. It is recorded that of 500 cases of cancer treated by Sir James Paget from 1843-61, two occurred in the tonsil, nine in the gums and palate, and thirty in the tongue.

It is only in the early stages that the exact site of origin of the growth can be determined. A tumour arising low down on the tonsil or anterior faucial pillar may soon spread to the tongue. Likewise a growth may rapidly extend from tonsil to palate, or from palate to tonsil. In a carcinoma of considerable dimensions the site of origin will generally be a matter for conjecture. A tumour originating in the lower part of the lateral pharyngeal wall, once it invades the tongue, usually

advances with great rapidity, and if the patient is seen for the first time when the disease has become extensive the diagnosis of primary carcinoma of the tongue will probably be made. This may seem of little importance, but there is some ground for believing that a tumour which is primary in the tonsil and extends to the tongue is more amenable to surgical treatment than one which has progressed in the reverse direction. Tumours originating in the pharyngeal portion of the tongue certainly belong to a very malignant class and they are likely to be early associated with wide spread and frequently bilateral cervical metastases. When the tumour occupies a central position, and more especially if it is close to the epiglottis, surgical removal is scarcely worth considering. When situated near the lateral margin of the tongue, and especially if there is reason to suppose that it began in the tonsil, its successful removal can sometimes be accomplished. If one considers the soft palate, tonsils and base of the tongue as forming an imaginary circle, the nearer the tumour is to the upper part of that circle, the more amenable is it to complete eradication. As we pass downwards the chances of success diminish to zero.

Palpation may reveal the presence of a growth which is invisible. This remark applies especially to the region of the tonsil. A tumour may originate at some distance from the surface in the epithelial lining of one of the crypts; only at a somewhat advanced stage will it give rise to an obvious swelling or ulcer, but in its early stage it may be detected on palpation. May not the tonsil be responsible more often than we think for these tumours in the neck, which are obviously malignant glandular metastases, and for which no primary focus can be discovered? In such cases it would be a reasonable procedure to enucleate the tonsil on the affected side and submit it to histological examination. Carcinoma of the oro-pharynx is so characteristic that it is not likely to be mistaken for any other disease, and mistakes in diagnosis ought to be extremely rare. I have, frequently, come across patients suffering from cancer in this region who have been treated for syphilis, the diagnosis being mainly based on a positive Wassermann reaction. On the other hand, I have rarely met with a case of syphilis which has been diagnosed as cancer. The former mistake is a very serious one. In most of my patients operation has preceded microscopic investigation, and in not a single instance was the clinical diagnosis of cancer proved to be wrong. Histological examination should therefore, as a rule, be post-operative. When it is thought desirable to have a pathological report before operation, the piece of tissue should be removed with the endo-thermy knife; the chances of dissemination of the disease are thus reduced to a minimum. The average age of the patient in my series of fifty cases treated by diathermy was 58. The oldest was 80, the youngest 38, only four were under 50, forty-eight were males, two were females. One case was proved microscopically to be an endothelioma of the tonsil and the patient was a woman. The other female patient suffered from a carcinoma of the uvula. In this series there is no case of carcinoma of the tonsil or pharyngeal portion of the tongue occurring in a woman. I have, however, met with two cases of carcinoma of the tonsil in women. One was sent to me for a second opinion, the other had inoperable glands in the neck. I have also had under my care a woman, aged 69, suffering from a tumour of the lingual tonsil, which proved to be a glandular carcinoma. I removed the tumour with diathermy and she is well after nearly six years.

With regard to the site of the tumour, the tonsil was more frequently involved than other regions of the pharynx. Perhaps malignant disease in this neighbourhood may in the future be even more rare, as the result of the very vigorous attacks which have for years been carried out on tonsils, large and small, offensive and inoffensive.

The results of treatment have been until comparatively recent times extremely poor and only isolated successes are recorded in the literature. Since the introduction of diathermy many successes have been obtained. In my hands radium has proved disappointing. Frequently an almost miraculous disappearance of the tumour takes place, followed too often by a recurrence, perhaps in an unusual

situation. There is always a risk of causing dissemination by inserting needles or seeds into a growth even if, in the case of a small tumour, an attempt is made to place the radium in the surrounding tissue only. We are all alive to the vast amount of work which is being done with the object of improving the results of radium and X-ray treatment. It seems not unreasonable to hope that in the future patients will be treated entirely by radiation from a distance, massive units of radium, or extremely short X-rays being employed. Encouraging results are being obtained at the Radiumhemmet in Stockholm and elsewhere. Personally, I hold the view that if there is a good chance of completely removing the tumour without undue risk to the patient, endothermy excision should be carried out, combined in selected cases, with drastic surgical removal of the gland-bearing areas. Probably in the majority of cases irradiation should follow operation. Before the employment of endothermy the usual precautions should be taken to render the mouth as clean as possible. To ensure eradication the healthy tissues must be severed at a sufficient distance from the growth. After removal of the tumour the resulting cavity should be treated with a button electrode. Adequate exposure can in every case be obtained by the use of the Davis gag or suspension apparatus. I do not consider that splitting the cheek improves the access to the tumour. Such a procedure as removal of a portion of the lower jaw, which increases the operative risk and leads to deformity, must surely seldom be necessary. Operations may be contra-indicated by the size or situation of the primary tumour, the age or general condition of the patient, or the existence of glandular masses which cannot be removed. The presence or absence of metastases makes all the difference in the ultimate outlook. Occasionally, however, an operation if sufficiently thorough, even when there are massive secondary glands, is rewarded with success. The treatment of the gland-bearing areas presents a more difficult problem than that of the primary growth. In connection with this matter I should like to say that: (1) It is impossible from a clinical examination to exclude glandular metastases. (2) Enlarged glands may be present, which after removal are reported on as non-malignant. (3) A primary growth situated on one side may be associated with bilateral glandular involvement, indeed the glands on the opposite side may be the first to become affected. (4) A negative report on tissue removed from the neck is not quite conclusive. Malignant cells may be present. (5) Glandular metastases may occur many years after a successful operation on the primary tumour. (6) Occasionally secondary deposits are present in positions inaccessible to surgery, e.g., the mediastinum. (7) When the primary growth occupies the oro-pharynx and if a gland operation is decided on, it must be most thorough and it may involve both sides of the neck. (8) Age or debility may be determining factors against operation. Unless there is reasonable hope of a lasting cure of the primary tumour, it is not permissible to carry out a block dissection. (9) In cases in which, for some reason or other, no operation has been performed on the neck, a careful examination of this region should be made at frequent intervals over a period of many years. When a gland operation is thought to be advisable, my practice is generally to operate on the glands on the diseased side and then allow a period of from two to three weeks to elapse before dealing with the primary tumour. The length of the interval depends on various circumstances.

The external carotid is generally ligatured at the time of the gland operation. In patients who have extensive growths it may be advisable—just before applying endothermy—to ligature the carotid on the non-affected side. This is an additional safeguard against hæmorrhage, but, more important still, the temporary devascularization of the tissue causes deeper penetration of the heat generated around the electrode.

There is difference of opinion with regard to the time of the attack on the primary tumour and that on the glands. Personally I prefer the neck operation to be a prelude to that on the primary tumour. One of my main reasons is

that after endothermy changes frequently take place in the cervical tissues which render the dissection more difficult and possibly less complete. In certain patients the procedure is reversed, and there is little doubt that in a good many cases it is better to keep the neck under observation, treating it by irradiation. Some surgeons recommend the use of endothermy dissection in the removal of the cervical glands. I can see no advantage in this method which fails to seal any but the smaller vessels, and which is dangerous when used in this vicinity of large vessels or important nerves. Endothermy may be used for the removal of a suspicious gland when a pathological report is desired.

In dealing with carcinoma of the oro-pharynx we cannot expect brilliant success such as can be obtained in intrinsic cancer of the larynx. There are many reasons for this. I will only mention the menace of sepsis and the extreme difficulty of dealing adequately with the glandular fields. I give below a few statistics of cases treated by me at the London Hospital which will, I hope, prove the value of diathermy. I should like to point out that many of my patients were suffering from advanced disease.

VARIOUS REGIONS INVOLVED.

Tonsils	70%
Pharynx and fauces	50%
Soft palate	46%
Tongue and floor of the mouth ...	40%
Alveolus	16%
Naso-pharynx	2%
Cheek	2%

SURVIVAL AFTER OPERATION OF CASES TREATED BY DIATHERMY OR ENDOTHERMY EXCISION.

Case	Years	Months	Case	Years	Months	Case	Years	Months
1	14	—	18	—	8	35	—	7
2	D	—	19	—	1	36	7	4
3	14	6	20	1	—	37	1	—
4	1	—	21	8	5	38	6	10
5	D	—	22	3	7	39	6	9
6	—	3	23	—	7	40	—	3
7	D	—	24	1	3	41	D	—
8	1	5	25	—	6	42	D	—
9	D	—	26	D	—	43	5	10
10	13	—	27	8	7	44	1	10
11	—	11	28	1	6	45	2	4
12	—	10	29	—	5	46	—	6
13	4	3	30	5	6	47	—	6
14	D	—	31	2	7	48	1	—
15	—	7	32	1	1	49	—	10
16	—	7	33	—	7	50	D	—
17	11	3	34	—	4			

Radiological Treatment of Some Cancers of the Oro-pharynx.

By Professor J. MAISIN (Director of the Cancer Institute), Dr. L. VAN DEN WILDENBERG (Professor of Otorhinolaryngology), and Dr. H. CH. VASSILIADIS (of the Cancer Institute, University of Louvain).

Sarcoma of the tonsils.—This group of tumours consists mainly of lymphosarcoma, malignant lymphocytoma, lymphoblastoma and reticulo-endothelial sarcoma. The lymphocytoma and lymphoblastoma are very radiosensitive. The common type of reticulo-endothelioma is also very radiosensitive, but the spindle-celled reticuloma

resembling closely the common spindle-celled sarcoma is very radio-resistant. Fortunately this last type is very rare.

Ten years ago we treated some of these tumours by radium needling of the primary growth and external radium applications for the glands. One patient treated by this method is still alive and well after eight years.

At the present time we are not needling tumours of the tonsils, on account of the risk of hæmorrhage and also on account of the good results obtained with external radiation alone. We have also treated a few patients by external radiation with a radium bomb. One of these patients, suffering from high blood-pressure, died three years after treatment without trace of recurrence.

The majority of our cases are, however, treated by external application of X-rays on account of the radiosensitivity of these tumours. We treat them by our routine technique: 180 or 200 kilovolts, filter 1 mm. of copper; 40 cm. distance from the skin; 1,500 r. on each field. We give two or three different fields a posterior one and two lateral ones. As a rule we give 300 to 500 r. a day. The tumours disappear quickly, and at the end of the treatment they have as a rule entirely gone. Except for very large tumours and weak patients we have never found it dangerous to give at once 300 or 500 r. directly to the tumour. The reaction the first day or the following day is as a rule marked on account of the radiosensitivity of the tumour, and it may be an indication not to repeat the dose every day during the first week of treatment.

When we have to treat a patient with a primary tumour without metastasis, or with a simple chain of enlarged glands on the corresponding side of the neck, we radiate not only the invaded region but also the opposite side of the neck. Six weeks after the first treatment, if the patient has poor general health, or immediately after the local radiation if the general condition is good, we radiate the mediastinum and the corresponding axillary region, as a prophylactic measure.

TABLE I.—SARCOMA.

(A) *Without metastasis.*

Number of cases treated	Healing of primary lesions	Survival				
		Months	Years			
		6	1	2	3	5	9
7	6	5	5	5	4	1	1

(B) *With metastasis.*

2	2	2	2	2	still living

Sarcoma of the tonsil with local neck metastasis alone is a suitable tumour for treatment with X-rays, and it is no longer a hopeless disease.

(2) *Epithelioma.*—Epithelial tumours of the oro-pharynx are more difficult to treat with success. Many of them are radio-resistant. As a rule the patients come very late when the metastases are large and widespread. To get results we have to give large amounts of radiation and the reactions are very severe. Good and permanent results are easy to obtain in the treatment of cancers of the anterior two-thirds of the tongue, which may be considered as a very suitable cancer for radium treatment. Results are, as a rule, poor in cases of cancers of the oro-pharynx.

It is easier to cure the local lesion than the metastases, with external radiations. For this reason when the metastases are operable it is still preferable to operate by a block dissection of the whole lymphatic system of the neck. It is necessary to dissect both sides, and it is advisable to do this in two stages. Even after a good surgical dissection we treat the whole region carefully to prevent recurrences.

The two best methods of external radiation are telecurietherapy and the teleroentgentherapy or Coutard method.

If a large amount of radium is available, 4 grams or more, telecurietherapy is a very good method for all cases. We have only 3 grams of radium bromide and for this reason we are compelled to treat by this method only the cases with long thin necks. For the short, fat, large neck, it is impossible with such an amount to get a depth dose large enough to cure. Our outfit is a lead bomb. The largest field is a square of 12 by 12 cm., the smallest a square of 6 by 6 cm. The distance of the radium from the skin is 6 cm. We get the erythema doses in fifteen hours and a destruction of the epithelium in twenty hours. As a rule we give three fields, two lateral ones and one posterior. On each field we give at least fifteen hours; very frequently twenty. Smaller doses are not effective.

The Coutard method is the one mainly used in our Institute to treat cancer of the oro-pharynx, because it gives very uniform results, as good as those obtained by telecurietherapy.

To get good results it is necessary to use hard rays, with the shortest wave-length possible, in order to improve the power of penetration and to increase the selective action on the cancer cells. To obtain such rays we use at least 200 kilovolts and we use a filter of 2 mm. copper. With such a filter we absorb all the soft rays, and the lesions of the skin and of the subcutaneous tissue are reduced. The skin in such condition can stand 1,500 and even 2,000 r. The distance between the target and the skin is 60 or 70 cm., and the intensity is no higher than 4 milliamperes. We radiate the patient at least two hours a day, delivering each day a dose of 500 r. The whole treatment must have a duration of three weeks, or even more. We have often radiated a patient during four weeks or thirty-five days.

If the treatment would be too short by using 4 milliamperes, we decrease the milliamperage to 3 or 2 milliamperes in order to be able to radiate the lesions every day over a long period. We think that the duration of treatment and a long daily irradiation are factors in success more important than the wave-length.

After such a treatment the reactions are very marked and they often begin before the end of the irradiation: the whole mucosa is covered by a whitish fibrin-film, and the epithelium is destroyed; the lips suffer considerably and often bleed. During the whole reaction it is important to keep the mouth clean by washing with a weak antiseptic solution. The duration of the reaction is generally four weeks. The results are given in the following tables:—

TABLE II.—CARCINOMA OF THE BASE OF THE TONGUE AND PHARYNX.

Without Metastasis.

Treated by X-rays only.

Number of cases treated	Healing of primary lesions	Survival: Months 6	Years 1	2	3	4	5
32	6	10	6	5	—	—	—

With Metastasis.

Number of cases treated	Healing of primary lesions	Healing of primary lesions and metastasis	Survival: Months 6	Years 1	2	3	4	5
16	4	3	3	3	2	2	1	1

TABLE III.—CARCINOMA OF THE TONSIL.

Without Metastasis.

Treated by X-rays only.

Number of cases treated	Healing of primary lesions	Healing of primary lesions and metastasis	Survival: Months 6	Years 1	2	3	4	5
12	5	—	8	6	3	still living		

With Metastasis.

5	2	—	3	3	2 are still living			

From these charts it is obvious that the primary lesion disappears under a good external treatment more readily than the glands do. The secondary deposits in the glands of the neck are more radio-resistant. For this reason, we repeat, whenever surgical dissection is possible it must be performed and followed by the X-ray treatment.

We have made a biopsy in all our cases, and we do not find that this slight trauma is dangerous. It may be dangerous in cases of such cancers as those of the breast, or melanoma, to make a biopsy, but it is not so in cases of epidermoid ulcerating carcinoma.

Our statistics show that even with the best treatment we have a large percentage of failures, and therefore for several years we have been trying various kinds of medical treatment in order to improve our radiological results. During the last two years we have used with some success injections of lipoid extract of the brain, the thymus, the bone-marrow, and the spleen. Our extracts are ethereal vacuum extracts, made *in vacuo* out of fresh calf organs. With the dried substance we make a colloidal watery suspension which is injected under the skin three times a week. These injections produce no general reaction and, following them, the general condition of the patient improves. The efficacy of the method is not sufficient for it to be used alone. We have been able to make small cancers of the skin disappear, but such results are exceptional and not the rule. From time to time one can retard the growth of large cancers by treating them by this medical method alone.

Another medical treatment we have used for two years is the administration of a small amount of barium by mouth. It is necessary to use extremely small doses, *e.g.* from $\frac{1}{500}$ to $\frac{1}{100}$ mgm. a day given in the morning before a meal with a small amount of distilled water in order to avoid the precipitation of the barium as an insoluble salt.

Larger doses such as one mgm. a day, which is still a very small dose, make the cancer grow more quickly and thus produce an opposite result to the one desired. The nature of the salts used is very important. The best we have used till now are gluconate of barium and saccharate of barium, but no doubt a better form of administration will be discovered. When we get a good result with a definite dose we keep this dose unchanged for a long time, changing it only when the case no longer responds well. It is necessary to give these salts for a long time for several months, because we have noticed frequently recurrence after the patient had stopped taking the drug.

Used alone the method gives sometimes, but rarely, definitely good results, sometimes a disappearance of a growth, but often no good results; together with X-rays it improves the results. Very small doses ($\frac{1}{500}$ to $\frac{1}{100}$ mgm.) are without the slightest danger. Often we use together ethereal extract and barium salts.

The following tables show the results which we have obtained by using the Coutard method, together with medical treatment. Of the epithelial cancers we think that lympho-epithelioma is the most radiosensitive, then the epidermoid carcinoma without pearls, the true spindle-celled epidermoid carcinoma with horny pearls being the most resistant form.

TABLE IV.—CARCINOMA OF THE BASE OF THE TONGUE AND THE PHARYNX.

Without metastasis.

Treated by X-rays and medical method.

Number of cases treated	Healing of primary lesions	Healing of primary lesions and metastasis	Survival						
			Months	Years					
			6	1	2	3	4	5	9
17	12	—	11	9	4	—	—	—	—
With metastasis.									
7	4	3	4	4	2	—	—	—	—

TABLE V.—CARCINOMA OF THE TONSIL.

Without metastasis.

Treated by X-rays and medical method.

Number of cases treated	Healing of primary lesions	Healing of primary lesions and metastasis	Survival: Months 6	Survival: Years 1	Survival: Years 2
0	0	0	0	0	0
With metastasis.					
5	3	2	3	3	2

We have regarded this paper as a personal one, and for this reason we have not given papers of other writers. As everyone knows, however, these radiological methods have been employed in various clinics on the Continent; Coutard of the Radium Institute of Paris is doing some of the best work on the subject.

Conclusions.—(1) It is possible to cure sarcomas of the tonsils with external radiations alone.

(2) It is possible to cure local epithelial cancers of the oro-pharynx with external radiations alone.

(3) The glandular metastases of epithelial cancers are more resistant than the primary lesions. For this reason it is advisable to operate when possible and later radiate the whole region dissected.

(4) The percentage of cures is small.

(5) We describe a medical method of treatment which seems to improve our radiological methods.

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Wilfred Trotter: My first point for comment is the principle which Mr. Gordon-Taylor lays down that in early cases when the growth is superficial it is unnecessary to insist upon a gland dissection being done of course and at once. That is a most admirable dictum. When we can reach a point in the treatment of this particularly deadly kind of cancer, at which experience tells us we can, on occasion, spare the patient some of the suffering which is involved in the full orthodox treatment, we should grasp that opportunity. I am very glad that that principle has been put forward with Mr. Gordon-Taylor's great authority.

Mr. Gordon-Taylor referred to two operations that I have recommended in the past. One of them, in which access to the pharynx is obtained by dividing the mandible at the side, he condemns, and in that opinion I cordially agree; I have abandoned this operation for many years.

He speaks unfavourably also of the operation I have called median pharyngotomy. This operation I still think, in spite of his criticism, has a definite usefulness in cases of comparatively early tumours close to the middle line on the epiglottis or the back of the tongue. It is almost the only operation by which the radical cure of growths fairly far down the pharynx can be obtained without any mutilation. It exposes the growth by a method which adheres closely to the middle line and scarcely causes any bleeding. In the case of a growth which is suitable, by this procedure one can remove the epiglottis and anterior wall of the larynx down to the vocal cords, and can get something approaching primary union. Moreover, the patient may be speaking and swallowing almost normally within a fortnight, with no visible scar

except that in the middle line of the lower lip. I admit that the procedure has great limitations, but in a suitable case it has all the advantages which an operation should possess.

Douglas Harmer said that he had watched the changes that had taken place in the treatment of these growths—first, as assistant to Sir Henry Butlin, when treatment was by surgical methods, then, under the guidance of Dr. Lewis Jones, by diathermy, and for the last twenty years by irradiation. The three methods of dealing with these tumours should not be pitted one against the other, as each had special uses and in certain cases all might be necessary to obtain a good result.

The first question that arose was: What is the best treatment for any special case? Here the question of biopsy was very important. On general principles it was inadvisable to disturb the primary growth if one could be quite certain of the clinical diagnosis, but the tumours in the oro-pharynx varied so much in their grade that this was frequently impossible; hence biopsy was often necessary. To avoid, as far as possible, risk of dissemination, he agreed with Mr. Patterson that the biopsy should be carried out by diathermy. Many surgeons now realized this danger and believed that dissemination could be caused by continual handling of the tissues, the malignant cells being forced by massage into the lymph stream.

In deciding upon the treatment there were many important factors: the most important was the type of the disease. It was becoming generally agreed that for rapidly growing sarcomata, lympho-epitheliomata and transitional-celled carcinomata, surgery, and even diathermy, were attended by grave risks, whereas they responded well to ray treatments. Then there was the question of the best treatment for early carcinomata. In such situations as the lip and the anterior part of the tongue, growths generally disappeared if surrounded by radium, and if the radiologists could obtain as high a percentage of cures as with surgery it was not difficult to visualize the time when this treatment would become more popular. For early growths, however, surgery also gave good results. He advised the surgeons to stick to their surgery unless they were continually working at radiology.

Radiologists were also called upon to treat many border-line and truly inoperable cases; in these it must be realized that cures were not being attempted, the object of treatment being to afford palliation.

In various parts of the world different methods were being tried. In the oro-pharynx tumours were at such a distance from the surface that it was rarely possible to cure them by superficial irradiation alone, either with X-rays or the bomb. When the growth was deeply seated it was difficult to deliver the necessary dose to the growth without doing serious damage to the skin, the bones, and the mucous membranes. Therefore the general principle was to give part of the dose by surface X-rays or radium and then to supplement it by some form of interstitial radiation. The use of small doses was a waste of time and also a grave risk.

W. S. Dickie said that he would confine his remarks to the condition usually called tonsillar cancer; though his own view was that cancer did not occur in the tonsil primarily, and that in these cases the origin was really at the lower part of the anterior pillar of the fauces. In frequency they now took the place of lip cancer.

He did not think that cancer of the anterior pillar of the fauces readily infected the lymphatic glands. It was, in his view, essentially a local disease. In most cases it was a hypertrophic type of growth, it was not ulcerative or fungating. Early it was a scirrhous growth, involving the glands only slightly. The patient complained of a lump in the neck and pain in the ear, and the swelling in the neck was usually a direct extension of the growth from the pharynx, not a glandular involvement. Unfortunately, that type was usually far advanced when the patient came for advice, and, in the nature of things, it was difficult to treat, as, from the

early stages, it tended to involve the bone, and the bone condition dominated both the operation and the prognosis.

As other surgeons had done, he had arrived at the use of a definite operation and had been practising it for thirteen years. His contribution was based on thirty operated cases. The operation was a serious and mutilating one, and he did not readily undertake it. He had hoped that radium and other treatments might have absolved him from the necessity of carrying out such an operation, and for a period of eighteen months he had sent all his cases to accredited radium centres for treatment, but the results were so disappointing that he had felt compelled to return to operative measures. He made a block dissection of the upper part of the neck on the affected side, divided the lower lip and chin in the middle line, reflected the cheek, and resected the lower jaw from the canine fossa, back to, and including, the coronoid process and condyle. Excision of the growth was then relatively easy, even though it often involved resection of the lateral wall of the pharynx from the maxilla down to the hyoid bone, with half the soft palate, the lateral fauces and the back part of the side of the tongue. An essential part of the operation was the reconstruction of the pharynx. Notwithstanding the extent of the defect which remained after the removal of the affected tissues, thanks to the preceding free removal of bone, such reconstruction had always been found possible by using the tissues of the cheek and the tongue. In the thirty cases there had been seven deaths; there had been recurrences at varying periods under five years in fifteen cases; eight cases had survived over the five-year limit, and in one, more than eleven years had passed since the operation.

W. Langmuir Watt: The most unsatisfactory cases have been post-operative recurrences. In these cases either surgery or radium, or a combination of both had been used. Recurrences were rapid and very malignant. The average time was about five months. It would seem that in the late operative cases one must give a complete knock-out blow on the first attempt. I suggest in these cases a full series of deep therapy treatment to the growth, and to infected glands if any are present, to be completed in from seven to ten days, and twenty-four days later an operation either alone or combined with radium. If operation is the treatment then I suggest only a second full series of deep therapy twenty-eight days later. If radium has been used I suggest waiting two months.

Dan McKenzie supported Mr. Gordon-Taylor's attitude. It was many years, he said, since he first used diathermy, and advocated it as a proper treatment in many cases of epithelioma of the oro-pharynx, and in the face of much opposition it had made its way.

Mr. Norman Patterson's results were very good; and as far as they went, his, the speaker's, cases supported them. In eleven cases the primary growth had been excised by diathermy, no radiation having been used, so they could be claimed as pure diathermy results. What he practised was diathermy excision; he did more than coagulate the growth *in situ* if excision was possible, because it was difficult to be sure one was coagulating the whole of the growth and the immediately surrounding tissue.

ELEVEN REMOVALS BY DIATHERMY EXCISION.

Recurrence.—Six. Two immediate (probably incomplete removal); two in a year; one in three years; one in five years.

No recurrence in five; two alive after four years; one after five years; one after six years; and one died of morbus cordis after twelve years.

(In the last, microscopic proof of the disease was not obtained as it was my first case and the specimen was destroyed by diathermy. Clinically, it seemed to be epithelioma.)

Excluding that we have four non-recurrences out of ten cases for four years and over.

T. B. Jobson said that of 28 cases of malignant disease of the pharynx seen during the last eight years, 22 had been in the oro-pharynx, including eight cases of cancer of the epiglottis. The treatment had been by diathermy, followed in some cases by X-rays or radon. There had been one slight hæmorrhage after diathermy and one fatal hæmorrhage after irradiation. In one case the growth extended from the edge of the uvula over the right tonsil almost to the tip of the tongue, and the patient was still alive after five and a half years. Another patient in whom the growth was restricted to the epiglottis remained well after three years. Diathermy had given great relief to pain and dysphagia in advanced cases.

G. Gordon-Taylor (in reply) said he was in almost complete agreement with Mr. Patterson and Dr. McKenzie in his advocacy of diathermy.

With regard to the risks attendant on a biopsy: If biopsy had to be carried out in a case of malignant disease it should be performed with the endothermy knife, and should be preceded by some form of radiation. He was sure that in cases of carcinoma of the breast and of many other forms of malignant disease, biopsy, even when done at the same time as the operation, had led to widespread metastasis; frequently it had been followed by disastrous results within a short time.

In all the enthusiasm felt for radiation it was important to keep constantly in mind that the lot of the poor patients subjected to these procedures was not all *couleur de rose*, that their life's path might be indeed a "via dolorosa," and that in many cases the prolongation of a life of misery by radium or other form of irradiation only made these unfortunate people "drink still longer of death."

Norman Patterson (in reply) said that the question of dissemination was a very important one. He recalled a case in which there had been a tonsillar carcinoma, with a large mass of glands in the neck. These he had cleared out, and he had later inserted radium needles into the tonsil. Five months afterwards the patient died from what was diagnosed as abdominal metastasis; he thought he must have caused dissemination of the cancer-cells when he plunged the needles into the tumours; as secondary growths in the abdomen must be very rare in these cases.

Professor Maisin (in reply) said he thought sarcomata should not be treated by surgery. They were highly radio-sensitive, and equally good results were obtained by ray-treatment. He had patients still living who had been treated only externally, and there was now no trace of disease.

CASES.

Malignant Disease of the Right Fauces treated by Radium.—MUSGRAVE WOODMAN (President).

Male, aged 58, admitted May 24, 1931, complaining of discomfort at the back of the throat, of five months' duration. An irregular reddened area was found at the lateral extremity of the right anterior pillar of the fauces, $\frac{3}{4}$ in. in diameter, with some hard fixed glands on the right side. The histological report showed it to be an epithelioma.

Eight radium needles were inserted into the growth and afterwards a radium collar was applied to the neck. The growth disappeared and the patient remained free for five months; there was then small recurrence. Four radium needles were inserted and the recurrence disappeared. In March, 1932, the glands on the right side of the neck were dissected out.

There is now (twenty months after the first application of radium) no sign of recurrence; the patient's condition is very satisfactory, and he has gained a stone in weight.

Malignant Disease of the Palate treated by Radium.—MUSGRAVE WOODMAN.

Male, aged 61, admitted June 16, 1931, with a squamous epithelioma at the posterior end of the hard palate, invading the soft palate. There were no palpable glands. Eight radium needles and five radon seeds were inserted into the growth, and considerable improvement resulted. Three months later further radium needles were inserted, and in December of that year there was found to be no growth.

The case has been carefully watched; there is no trace of any recurrence and the patient is steadily putting on weight.

Two Cases of Angeio-fibro-sarcoma operated on by Diathermy Eight Years and a half and Four Years ago respectively.—E. BROUGHTON BARNES.

(I) Male, aged 19. Pedunculated angeio-fibro-sarcoma removed from basi-sphenoid by diathermy snare in August 1924.

The post-nasal space is normal, except for a small red nodule at the upper end of the posterior edge of the vomer.

(This case was shown at a previous meeting of the Section in connection with the use of the diathermy snare in cases with narrow attachments.)

(II) Male, aged 17. Angeio-fibro-sarcoma removed by diathermy, February, 1929. The tumour appeared to originate from the basi-sphenoid, but when seen it filled the post-nasal space and extended into the right ethmoid. It could be seen from in front as a smooth greyish mass protruding beneath the right middle turbinate.

The mass in the ethmoid was removed through the nose for section and the cavity heavily treated with the diathermy button.

The section shows angeio-fibro-sarcoma but much less vascular than that in the first case. The post-nasal mass was later attacked through the mouth with special diathermy terminals shaped like a Dutch hoe.

There were heavy vascular attachments to the posterior edge of the vomer, to the right inferior turbinate and to the right lateral pharyngeal wall in the fossa of Rosenmüller. The right inferior turbinate was wrenched out attached to the growth. The whole cavity was gone over again with a diathermy button.

Endothelioma of Soft Palate. Removal by Diathermy Five Years ago. No Recurrence.—DAN MCKENZIE.

After treatment by radium elsewhere and recurrence, the entire soft palate was removed by diathermy in August, 1927. The right external carotid artery was ligatured and glands and gland-bearing fascia were removed. The glands were reported (by Dr. A. Renshaw of Manchester) to show suspicious masses of endothelial cells.

Neither radium nor X-rays have been used since the operation.

Epithelioma of Tonsil and Faucial Pillar removed by Diathermy Four Years ago. No Recurrence.—DAN MCKENZIE.

The extent of the operation can be gathered from the gap in the pharynx. The left external carotid artery was ligatured and the sterno-mastoid and the gland-bearing fascia on the same side of the neck were removed.

Neither radium nor X-rays have been used at any time in this case.

Two Foci of Carcinoma and one of Lymphosarcoma in the Course of Ten Years, all "cured" by Deep X-rays.—W. M. MOLLISON.

Male, aged 73, had an epithelioma on the posterior surface of the tongue in 1923; treated with deep X-rays with complete disappearance of growth.

In 1930, carcinoma developed in the right side of the nasopharynx; this also completely disappeared under deep X-ray treatment.

In October, 1932, a growth appeared in the left tonsil. Microscopical examination showed this to be lymphosarcoma. Deep X-ray treatment was again given with complete success.

Carcinoma of Vallecula cured by X-ray Therapy.—W. M. MOLLISON.

Male, aged 57, in 1926 had carcinoma at the back of the tongue, spreading down to the epiglottis. Treatment by diathermy was attempted but was without result. Deep X-rays caused disappearance of growth.

The patient was still quite free from growth in 1929.

Post-cricoid Carcinoma: Condition much improved by Deep X-rays.—W. M. MOLLISON.

Patient, female, aged 55. Epithelioma of post-cricoid space, September, 1932; only fluids could be swallowed. Deep X-rays were applied. Now (February, 1933) the patient swallows minced meat and fish with comfort, though there is still some ulceration of the posterior pharyngeal wall just above the arytenoids.

Carcinoma of Oro-pharynx.—F. C. W. CAPPS.

Patient, male, aged 48, first seen on August 31, 1932, complaining of stuffiness of nose, sudden onset of deafness, and squint (five weeks' history).

In 1916 had a gunshot wound passing from right side of face through nose and out under left eye.

On examination last August, a large mass was found in the post-nasal space, more on the right side than on the left. There were multiple old adhesions in the nose on both sides. Tympanic membranes indrawn and middle-ear deafness of marked degree. No cervical lymphadenitis. Microscopical examination revealed epithelioma. Full course of deep-ray therapy has caused complete disappearance of the growth and has restored the hearing. External rectus palsy is still present.

Epithelioma of Tonsil treated by Radium Needles.—LIONEL COLLEDGE.

Male, aged 68. An epithelioma of the right tonsil and anterior faucial pillar, reaching the edge of the tongue, was treated in March, 1931, by six needles each containing 1 mgm. of radium and left in position for ten days. There was no evident enlargement of the lymphatic glands. The pharynx now remains normal.

Sarcoma of Tonsil treated by Radium Needles.—LIONEL COLLEDGE.

Patient, male, aged 35, was seen in September, 1931, on account of ulceration of the left tonsil, of eight weeks' duration, with enlargement of the glands at the angle of the jaw. A large sloughing ulcer with sharp raised edges was diagnosed as a gumma. The Wassermann reaction was negative and the condition did not respond to anti-syphilitic treatment. A piece removed from the edge was examined by Dr. E. L. Hunt, who reported sarcoma. On October 10, 1931, six needles containing 1·5 mgm. each of radium were buried round the ulcer for ten days and on November 7 three needles, each containing 0·5 mgm. of radium, were inserted into the base of the tongue. There is now no abnormality except that the left tonsil has disappeared, leaving slight scarring. The patient has gained a stone in weight.

Lympho-Epithelioma of Tonsil and Tongue, treated by Radium, with recurrence after three years.—F. J. CLEMINSON.

Female, aged 54. The patient was first seen in May, 1929, when she had an ulcer of three months' duration on the left tonsil. Microscopical examination did not show definite malignancy. Tonsils removed, further examination showed lympho-epithelioma.

July, 1929: Ulceration reappeared in left tonsillar fossa and on adjacent edge of tongue. This was treated by interstitial radium and by surface radium.

October, 1929: Tongue appeared to be normal; no enlargement of cervical glands.

The condition remained the same until October, 1932, when an ulcer appeared on the right side of the dorsum of the tongue. Patient has again been treated with interstitial radium and with external radiation given by means of a 1 grm. radium bomb.

At present the right side of the dorsum of the tongue is slightly swollen, and protrusion is not normal, but there is no induration or ulceration.

W. S. DICKIE showed the following cases:—

Epithelioma of Fauces.—Male, aged 54. Growth involved right lateral fauces, lateral wall of pharynx, soft palate, alveolar margin lower jaw, inner surface cheek.

August 14, 1922.—Block dissection of upper part of side of neck. Division of lip and chin in middle line. Reflection of cheek. Resection of lower jaw from lateral incisor to and including condyle and coronoid. Excision of growth, including portion of upper jaw, soft palate, anterior pillar of fauces, portion of lateral wall of pharynx and part of cheek. Reconstruction of lateral wall of pharynx and inner surface of cheek.

July 9, 1932.—Small recurrence on inner side of right cheek away from line of scar, just behind and above the orifice of Stenson's duct. Destruction with electric cautery.

January 22, 1933.—Recurrence.

This case shows that notwithstanding the extensive operation and the resulting mutilation, the patient has been able to lead a normal life and do heavy work.

Cancer of Right Lateral Fauces.—Male, aged 54. Malignant ulcer, measuring about $1\frac{1}{2}$ in. by $\frac{3}{4}$ in., with surrounding infiltration, centred over lower part of anterior pillar of fauces, extending backwards over tonsil, forward over lower jaw, upwards on to soft palate and close to posterior part alveolar process of upper jaw, downwards into base of tongue. Enlarged glands in carotid area.

June 7, 1928.—Block dissection. Cheek reflected. Resection of lower jaw from canine back to and including condyle and coronoid process. Excision of growth, including tonsil, lateral wall of pharynx, anterior pillar of fauces, portion of base of tongue, one-third of soft palate, posterior part of alveolar process of superior maxilla. Reconstruction of mouth and pharynx.

July 22, 1928.—Went home. Very well.

Cancer of Right Pillar of Fauces.—Male, aged 60. Extensive disease coming unusually far forward into tongue, as far as midline and to opposite bicuspid teeth, down nearly to hyoid bone, adherent to jaw, backwards over tonsil and lateral wall of pharynx but not so far backwards as usual nor far up on the soft palate. There is a definite lump in the neck behind the angle of the jaw, fixed; either glandular or a direct extension of growth.

December 2, 1932.—Block dissection. Reflection of cheek. Resection of lower jaw. Excision of growth. Reconstruction of pharynx. In this case the unusual forward extension of the disease into the tongue necessitated the division of the jaw in the lateral incisor area and a great resection of the tongue. Further, as the lump in the neck proved to be a direct extension of the primary growth adherent to the jugular vein, ligature and resection of a segment of the vein was needed.

December 23, 1932.—Went home. The wound had quite healed within the fortnight following operation, though fluids came through it from about the fourth to the tenth day.

Section of Tropical Diseases and Parasitology.

President—H. S. STANNUS, M.D.

[*February* 2, 1933.]

An Examination of Tropical Neurasthenia.

By Professor MILLAIS CULPIN, M.D., F.R.C.S.

ABSTRACT.—The nineteenth century conception of neurasthenia is giving way to a psychological ætiology and classification. Quotations show that the older conception dies hard, and varied physical factors are invoked as causes of tropical neurasthenia.

Australian experience shows the physical factors present without "neurasthenia." It is suggested that mal-adjustment is not physiological but sociological.

The possibility of psychoneuroses appearing in the guise of tropical diseases.

Effect of selection of personnel in reducing breakdown.

The writer doubts the existence of a neurasthenia special to the tropics, and urges that the use of the phrase "tropical neurasthenia" should be discontinued.

BEARD popularized neurasthenia in the eighteen-sixties, and regarded it as a disturbance in the balance between nerve waste and nerve repair. The word added nothing to our knowledge, but this conception suited the mechanistic trend of the period, and the disorder took its place as a physical condition with a pathology that science was expected soon to demonstrate.

The first salvage from the rubbish heap of neurasthenia occurred in 1894, when Freud separated the group he calls anxiety neurosis; later he described anxiety hysteria, and these names are now in everyday use, though they should only be used in agreement with Freud's ætiology. I prefer to speak of anxiety states, thus avoiding the ætiological problem.

There are also found in the rubbish heap many examples of obsessional states. These are well described by Raymond and Janet in *Les Obsessions et la Psychasthénie*, and have scarcely reached our textbooks.

Anxiety and obsessional states rest on a psychological basis, and are, with hysteria, grouped as psychoneuroses or, in a more recent phrase, minor psychoses.

What is now left of neurasthenia? Some of my colleagues hold that there remain cases marked by chronic physical and mental lassitude and that this residue is "true" neurasthenia. An article by Sir T. Farquhar Buzzard [1] described the residue as *autonomous depression*, akin to the manic-depressive group, and the course of the cases confirms his view. The patients are irresponsive to the psychotherapy that can influence the anxiety states, but recover spontaneously. This view is not universally accepted by psychopathologists, but most agree that neurasthenia,

whatever their conception of it, is uncommon. In my examination of 1,500 people in the working population, though I passed only 50% as free from psychoneurotic symptoms, I found no need for the diagnosis of neurasthenia, but the patient with autonomous depression would not be found at work.

In the conditions we are discussing shall we postulate some alteration in the nerve tissues of the patient, for which we are to seek a physical cause, or shall we consider the trouble as a reaction of the man as a whole, expressed through his nervous system, through his viscera, his muscles, his endocrines, his emotions and his thoughts? The first choice was taken by nineteenth-century medicine, and the attitude of some of us is still determined by that choice. The second represents the psychological attitude.

To illustrate these attitudes we can turn to correspondence on our subject in *The British Medical Journal*, mostly in 1926. The Bishop of Singapore, who opened the discussion, spoke of four men who committed suicide; he said "Each, I believe, was beyond reproach as regards regularity of life." He pointed out that the same effects of tropical life were seen in Kenya as in Singapore, and suggested as a cause "the bright light of the long period of rainless days in Kenya" [2].

The next writer, H. W. T., says: "Many seek relief from domestic troubles by virtually giving up home life . . . over-indulgence in games, bridge, dinner parties, with their train of late nights, excitement, and excessive alcohol, . . . trying to make the time pass till the next leave comes, or nervous exhaustion drives them home" [3].

W. B. B., writing of Shanghai, notes the higher percentage of disablement in North China, where the air is keen and dry, than in Central China, where humid and sultry conditions prevail, and speaks about cerebral congestion and its effects [4].

R. V. S. speaks of "atonic dyspepsia and dilated stomach, which produce a neurasthenic condition. . . ." Referring to food defects he states that "the nerves are starved," but "if a man takes up a hobby keenly, no matter what it is, he scarcely suffers from the monotonous isolation and condition of his station" [5].

R. M. B. writes about the excess of neurasthenia in Canada, and traces it to the brightness of the sun's rays [6].

J. W. T. suggests "It may be that the electrical content or potential of the atmosphere in the tropics is less than it is in the temperate zones. The nervous mechanism of the inhabitant of the latter is attuned to work in the higher potential and, when transferred to an atmosphere with a lower potential, a continued leak from the analogue of his batteries occurs, resulting in the familiar nervous phenomena and ultimately necessitating long leave at home for re-charging" [7].

H. M. H. writes of the West Indies and of stocks of unmixed European blood. "Mental breakdown, or nervous trouble, is so little a feature of medical practice among these whites, West Indians and new-comers alike, as so far to have escaped any record." If these people go to tropical Africa they get invalided with neurasthenia. Mental irritability and breakdown of the white man in the tropics is not directly a medical problem, but rather the psychological one of citizenship and the herd [8].

E. R. H. tells of experiences at Archangel. "The outstanding feature was the frequent occurrence of various forms of neurasthenia" [9].

K. H. V. emphasizes the influence of food, drink, constipation, clothes, light and exercise [10].

A. S. M. says "The visible and invisible rays of the sun are the *fons et origo* of the trouble" [11].

L. E. M. notes that the trouble is due to changed environment rather than changed climate. The remedy lies in an appreciation of the danger and a knowledge of psychological factors [12].

Q. B. de F. thinks that the great cause of mental irritability in the tropics is the same monotonous daily grind, carried on under conditions of great physical exhaustion without the possibility of change of surroundings [13].

A. S. M. suggests that "comparative air stagnation has a very great deal to do with these tropical nervous cases" [14].

These extracts show fundamentally different conceptions of neurasthenia; no specialist in the psychoneuroses took part in the discussion, nor did any writer seem aware that the problem was a concern of psychopathology. . . .

For a graphic summary of undeniably noxious stimuli I turn to a paper by Dr. Stannus:—

> "Think of them—all associated with fear and anxiety. He is exiled from home; often separated from his family; generally unable to make ends meet for some reason or other; suffering, in many cases, loneliness and lack of congenial society; envious of others; disappointed over promotion; with ambition thwarted. Living amidst a native population causes him annoyance at every turn, because he has never troubled to understand its language and its psychology. From early morn till dewy eve he is in a state of unrest—ants at breakfast, flies at lunch, and termites at dinner, with a new species of moth every evening in his coffee. Beset all day by a sodden heat, whence there is no escape, and the unceasing attentions of the voracious insect world, he is driven to bed by his lamp being extinguished by the hordes which fly by night, only to be kept awake by the reiterated cry of the brain-fever bird or the local chorus of frogs. Never at rest! Always an on-guardness!" [15.]

Now for my own experience of the tropics. In Northern Queensland, on the Pacific side of Cape York Peninsula, is the port of Cooktown. Inland runs a railway, ending at the Laura river, and in 1892, fifteen months after leaving my native London, I fell into the position of schoolmaster in the Laura township, and stayed there nearly five years among white people who took for granted their fitness for permanent settlement in the tropics.

We were sixty-seven miles inland, about 250 ft. above sea-level, with an average yearly temperature of 77° and a rainfall of about 40 in., mostly in the first three months of the year. Latitude was about 15° S. The district was everywhere lightly timbered, being beyond the rain-forest area. This area is a belt along the coast with higher rainfall and vegetation of Malayan type, where the majority of the white population is gathered, occupied mainly in cane-growing.

The township depended on the carrying trade to cattle stations and gold mines up the Peninsula. There was a varying aboriginal population, about fifty blacks sometimes being in camp near by.

My average attendance was over thirty children, all of European descent. A doctor lived at Cooktown, but the only cases sent to him were a fractured femur, a fractured humerus and a probable renal colic. Two broken arms in children—one a greenstick radius and ulna, "put straight" by the mother—were not judged sufficiently serious for medical attention. One girl had an illness, probably lobar pneumonia, and recovered. One epidemic of conjunctivitis (called "sandy blight") in the school, disappeared when the rain came. Except for bad teeth the children would come up to ordinary health standards. The only death in the township was that of a bedridden boy, probably a case of hydrocephalus. Dengue fever visited us once; the patients, including myself, lay down till they felt better and then went back to work.

There were several large families. The wives of aristocrats, e.g., the store-keeper or station-master, went to town for their confinements, but the rest trusted to a neighbour. One mother of nine disdained even that help and went through her troubles unaided.

The men regarded hard manual work as a part of life. The women did nothing but house-work; in a few households a "black gin" would mind the children, or round up the goats that provided the bulk of our milk supply. Drinking customs in the bush are highly conventional, but there was no chronic alcoholism.

What distinguishes life here from the general life of Europeans in the tropics is that nearly everyone regards the country as a permanent home. For myself the spirit of the place caught me and I left with regret to go to a large school in Townsville, a port farther south, and now the seat of the Commonwealth Institute of Tropical Medicine. Here I became acquainted with Banfield, who afterwards wrote "My Tropic Isle" (Fisher Unwin). He was a sick man then, but he tells in the chapter "His Majesty the Sun" how he reached health again. "Let the sun scorch the skin and blister it until it peels, and scorches and peels again, and scorches and peels alternately until, having no more dominion over the flesh, it tinctures the very blood and transmutes mere ruddiness to bronze." And "all the hotter hours of the day have I worked in the bush, felling trees, sawing and splitting logs, and adzing rough timber, the while November's unclouded sun evaporated perspiration almost as speedily as it flowed. . . ."

There were three large schools in Townsville and I knew about a score of my colleagues. Some of them I met there twenty years later, when we talked about the old days; there was never any word of nervous troubles among teachers. Dr. R. W. Cilento, in "The White Man in the Tropics," writes [16]:—

> "Neurasthenics constitute a mere trifle of the total resident population of tropical Queensland, comprising a small percentage of the native-born women, particularly those who are engaged in a sedentary occupation, or who spend their lives under appalling circumstances provided by the outback tin shack. The indications of their neurasthenia are, as a rule, mild, manifesting themselves as an inability for concentrated effort, a marked tendency to inertia, and a revolt against circumstances,
>
> "Sundstroem, in a remarkable series of experiments carried out at the Institute of Tropical Medicine, Townsville (Australia), demonstrated that those people who most nearly approach what is considered the standard for temperate climates were people engaged in the arduous duties of wharf lumping, and a most significant result was obtained in the person of the caretaker of the Australian Institute of Tropical Medicine, who was found to reach a perfect standard of normality after she had spent two hard hours on a muggy tropical morning cleaning out the Institute. The least satisfactory of all tests taken was that from a girl who followed the sedentary occupation of stenographer, and who avoided every form of exercise.
>
> "The stenographer type contributes a considerable percentage of such neurasthenics as do occur in North Queensland, and to them must be added, as stated before, those women who pass the borders of physical resiliency by continued unjustifiable labour, day in day out, in grossly hot, ill-ventilated, and ill-built kitchens."

Here enters what I have come to regard as an important factor in the distribution of nervous breakdown—rigidity of occupational conditions. The working man in North Queensland can work where he likes, go South if he likes, but his wife is not so free. Cilento gives a glimpse of the same factor when he writes:—

> "Neurasthenia is by no means uncommon among coloured races, and in the experience of the writer it is more particularly seen in well-educated Indians, particularly Tamils, who have, for a long period of time, occupied junior official posts without the expectation or probability of advancement."

I will now give some impressions of five years' practice in Shanghai. Here we had a winter, generally with a fall of snow, and for only about six weeks was the weather unpleasantly hot and moist. Knowing nothing about psychopathology, I missed many cases that I can now diagnose retrospectively. Anxiety states

I treated valiantly but vainly with pharmacopœial remedies, and my impression is that they were commoner than in English practice. A saying often heard was: "Shanghai is a nervy place." I suggest that this was not the result of climate but had as one factor the opposite of Australian conditions; few people had the feeling of permanent domicile. Life was luxurious, recreation was abundant but artificial, and people expected to go home "on leave" about every three years. I think the poorer and permanent residents—mostly Eurasians—provided fewer nervous cases, and I discovered that pensioners from the lower ratings of the American navy retired to Shanghai, where, with a Chinese wife, they got better value for their money than in their native country.

Of the incidence of tropical neusasthenia I have no definite knowledge, but the returns of one establishment in London show two-thirds of a fairly heavy sick list to be made up, as regards long sick-leave, of nervous troubles. Perhaps some of you can tell me whether that proportion is reached in the tropics. But another consideration arises. Wherever he turns, the psychopathologist finds the minor psychoses classified as organic disease. The Army D.A.H., with 80,000 pensioned victims, was a psychoneurosis. Bowel troubles—mucous colitis is an example—are often the physical manifestation of an anxiety state, and among my troublesome cases of persistent diarrhœa in Shanghai some were, retrospectively diagnosed, psychoneurotic. Many nervous cases were invalided from the Army as malaria, and several men I saw diagnosed as "cerebral malaria" were such frank psychoneurotics that I did not trouble to do blood-tests. I was once summoned to an orderly in a shell-shock hospital who was having a malarial rigor. He was crouching over the fire, shivering and looking ill, but a short investigation brought from him the remark: "Well, sir, I never thought I should be like one of those chaps," for it was an emotionally motivated but unwitting mimesis. In the process of reviving a man's war memories I have induced a pseudo-malarial rigor that included sweating. Some of my colleagues tell me that a rise of temperature may occur in such "hysterical" manifestations. Psychoneurotic patients often describe acute anxiety attacks as malaria.

To show what can be done in controlling invalidity I may use, by permission of Sir John Cadman, the Medical Report of the Anglo-Persian Oil Company for 1929. Of thirty-five cases invalided from Irak and Persia, only one is ascribed to neurasthenia. Add, if you like, four cases of mental disease and one of epilepsy and then only one-sixth of the invaliding is due to minor or major psychoses. Yet, according to my own views, neurasthenia should be rampant, for the oil-fields offer no permanent home for Europeans. I can judge of the climatic conditions only from photographs of a desert-looking country, annual mean temperatures about 76°, and rainfalls of 7 in. or so, but I read that the region is well within the thermal tropical zone of Supan's classification.

Behind these low figures is an instructive story. When examining sickness returns, Miss May Smith and myself were struck by the low figures for the home staff of this firm—between four and five days per head per annum. We asked for a return showing the causes of all sickness of over thirty days' duration and noted an absence of the "neuro" group and its common equivalents such as gastritis, cardiac debility, and the like. We next obtained an interview with the medical officers and were told it had been found that members of the staff abroad, when selected only for physical health, would break down, or become alcoholic, or cause trouble by losing their temper with the natives. The chief medical officer, with uncommon psychological insight, had then devised a series of interviews with each candidate, directed towards an estimate of his temperamental type and modes of reaction. This was along the same lines as our investigations on "The Nervous Temperament in Industry" [17] in which we sought to establish standards of psychological fitness and to systematize a method of examination. So satisfied were

the firm with the results of excluding susceptible subjects, that they introduced the same plan when engaging home staff. The next step for us was to examine a number of the home staff by our own methods; we found that the percentage of subjects with hysterical or anxiety symptoms or tendencies had been reduced well below that in the general population whilst—for a reason that will appear later—what we call "obsessionals" were present in disproportionately large numbers.

Figures for the foreign staff show a reduction in those discharged, resigned, and invalided, from 19·8% in 1924 to 4·1% in 1929; the Report ascribes this result to the new method of medical selection in London, since temperamental unsuitability played an important part in the losses by discharge or resignation as well as breakdown.

As to the home staff, it is stated that "although an effort is made to exclude those who, to use a popular phrase, are 'temperamental,' great discretion must be, and is, exercised, as the 'highly-strung' are often the best workers, and to exclude them might deprive the Company of the services of men of exceptional ability." This accounts for the excess of "obsessionals" who, as we have discovered, are often of outstanding merits, but have a tendency to breakdown.

Exclusion of susceptible subjects cannot account entirely for the absence of nervous illness. Enough anxiety subjects had been let through to provide a few breakdowns, and the excess of obsessionals ought to show itself in nervous illness. We must bear in mind that the firm is vigorous, prospects are good for the efficient worker, and the percentage of satisfied employees is higher than in any other group investigated—except the laundry trade, in which over 90% have no wish to change their job. But I suggest another factor. A medical staff trained to pay attention to matters psychological in the selection of employees will pay attention to them in dealing with sick persons. Suppose things are going wrong with a man and emotional disturbances spoil his sleep, his digestion, or his capacity for work, and he seeks help from his doctor. Whether he is told to "take a tonic and have those teeth attended to," or whether the doctor says: "Tell me, what's worrying you?" may decide the development or arrest of a breakdown.

This episode supports the view that "tropical neurasthenia" affects the person who would tend to break down wherever he was. In every group of "neurasthenics"—war neurasthenics, subjects of miners' nystagmus, telegraphists' cramp, or of traumatic neurasthenia—is found the same general picture, and the cases of neurasthenia that I see from the tropics present nothing different. The medical officer to a group of tea estates came to me lately with a history of a nervous breakdown that had sent him home. He had sought advice, and an examination of his fæces for the presence of cysts was being carried out. Keen on his profession, he neither played cards nor drank, and had come into conflict with estate managers because of insistence upon what he believed to be the right thing; as a result, to loneliness was added financial loss. He was of the over-conscientious obsessional type that makes heavy weather of life, but does excellent work in the proper environment. After a talk he remarked, "It looks as if I must make up my mind to swallow some of my principles, or else hunt for another sort of job." I don't know what course he took, but if cysts are found in his fæces he would now take only an objective interest in the discovery. If a diseased condition calls for treatment on its own account, to give that treatment is common sense; to call a case "neurasthenia" and hunt for something to treat physically that of itself would be ignored is a "hunting of the snark."

Cases of tropical neurasthenia, excluding those of *tædium vitæ*, or deterioration from indulgence, or of debility from disease, should be grouped as "minor psychoses (or psychoneuroses) occurring in the tropics."

The false pathology underlying the phrase "shell-shock" was so harmful that its official use was prohibited. The conception of "traumatic neurasthenia," that

prostitution of scientific terminology, is responsible for life-long wrecks. For another example we may read up railway spine in Erichsen's "System of Surgery." The symptoms he described as due to spinal injury I have seen only in a ward full of shell-shockers; his mytho-pathology helped his patients on the downward path. The ideas involved in the phrases shell-shock, traumatic neurasthenia, and railway spine arose from nineteenth-century tendencies, and tropical neurasthenia belongs to the same group.

The minor psychoses, wherever they occur, are failures of adaptation dependent, firstly, upon predisposition. This can often be diagnosed by existing symptoms that do not produce disability, as shown by Miss May Smith and myself, and the method of examination can be taught.

In inverse proportion to predisposition is the stimulus needed to produce breakdown. This may be the stress of war, a rigid working environment, a frustrated sex life, nostalgia, the absence of satisfaction for the need to do something, an illness, anything that calls forth fear, obstacles felt to be insuperable; indeed, any of the difficulties or demands of life. One favourite cause, however, I reject. I do not believe that a nervous breakdown was ever caused by hard work. Hard work, mental or physical, may exhaust a man, but if he is happy in it the breakdown is physiological and recovery is swift. The urge to hard work that so commonly precedes suicides, and is described at the inquest as a meritorious quality, making still more mysterious the unexpected tragedy, is a symptom behind which lie unsuspected obsessional troubles. This explanation might account for the four suicides described by the Bishop of Singapore as "beyond reproach as regards regularity of life." For a mild example of the urge I refer you to the doctor whose impossible ideals were to be cured by hunting for entamœba cysts.

People in the tropics have nervous troubles just like people elsewhere; they may have more or less than other selected groups; the troubles arise as difficulties of emotional adjustment to harmful stimuli, some of which are peculiar to the tropics, and some dependent rather upon an attitude to life than upon climate. Prophylaxis lies in the psychological examination of would-be tropical residents. When the conditions arise they should be handled in accordance with modern knowledge of the minor psychoses. The idea should not be encouraged that there is something intrinsic to the tropics which specially disposes to breakdown, and the use of the phrase "tropical neurasthenia" should be discontinued.

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Discussion.—Dr. H. C. SQUIRES: "Tropical neurasthenia" is not an expression of which anyone interested in psychological medicine will be inclined to make use, and it is going the way of all topographical nomenclature. Everyone knows what he means by such a term, even if he is not quite certain what anyone else means by it. Personally I should interpret Dr. Culpin's title "An examination of tropical neurasthenia" as "An examination of those disabilities of Europeans in the tropics—other than psychoses—which come within the sphere of psychological medicine."

This subject is disowned by Tropical Medicine and neglected by General Medicine, with the unfortunate result that a doctor can go out to the tropics with an admirable diploma in tropical medicine and with excellent general qualifications, and yet know nothing whatever about conditions which, in my experience, are more prolific in causing chronic ill-health and invaliding among Europeans than all tropical diseases put together.

This is a statement of opinion that may be challenged. As Dr. Culpin has said, there are no very definite statistics on the subject. There are however some, and I would mention particularly the East and West African Vital Statistics published by the Colonial Office. It would be in the public interest if it were possible to publish similar returns for other tropical areas, and if the Indian Government or Governments would adopt a similar procedure.

Without laying undue emphasis on the meagre figures that are available, I should like to illustrate the relative importance of the subject by showing two tables. The first is a comparison of home and foreign statistics for the year 1930. The home statistics being those of the males of the established categories of a British Government Department, and the foreign being those published by the Colonial Office for the East and West African groups of Colonies and Protectorates. It would be possible to give much interesting and detailed information about these figures, but as it is I will content myself with drawing attention to the apparently greater incidence in the tropical figures of disabilities arising from psychological causes.

I.

COMPARISON FOR YEAR 1930 BETWEEN STATISTICS OF BRITISH GOVERNMENT DEPARTMENT AND THOSE OF EAST AND WEST AFRICAN GOVERNMENTS.

	Brit. Govern. Depart. Males	East and West African Govern.
Total wastage during year	32 per thousand	90 per thousand
Invalided	5·8 ,,	7·7 ,,
Invalided for psychoneurosis	0·57 ,,	1·5 ,,
Invalided for psychological reasons ...	1·0 ,,	2·9 ,,

II.

	Vital Statistics, East Africa, 1921-1930	Missionary Society, 1925-1931	S. G. Last 56 cases
Total invalided	193	104	56
Psychoneurosis	57=29% (25)	20=19·2% (9)	22=39·2% (9)
Epilepsy	4	—	—
Psychosis	11	4	2
Alcoholism	7	—	5
Asthma, migraine, nervous debility, &c....	9	11	7
Total for psychological reasons ...	88=45·6%	35=33·6%	36=64·3%

The second table shows an analysis of 353 cases of invaliding from the tropics, obtained from various sources. Granted that the diagnoses are correct, about 28% are invalided for various forms of psychoneurosis and about 45% for psychological reasons. I would draw special attention to the figures in brackets. These are the numbers included in the larger figures just above of those who are invalided for some form of psychoneurosis with less than four years' service. It is the most striking feature in the comparison between home and foreign statistics that while from the tropics a very large number of the psychoneurotic cases (43% in this table) are invalided during the first four years, at home about the same percentage is spread over the first twenty-five years of service.

I wish now to say a word with reference to the closely allied subject of acclimatization. For my second point is that what is of importance in the ætiology of tropical neurasthenia is not so much the action of abnormally severe stresses on average individuals but the action of stresses of a more ordinary severity, though possibly of an unaccustomed nature, on individuals of a special constitution. I do not dispute the fact that climatic conditions, temperature,

humidity, hot winds, light rays and other physical agencies bring about changes in the human organism which in certain circumstances may have serious and harmful results. But I believe that in a large number of cases in which selected candidates for posts in the tropics find it difficult to carry on under the new conditions, even where reasonable care and precautions are taken, there are emotional factors at work which are more important than these physical agencies. Many of the individuals who find acclimatization difficult are, on investigation, found to bear the definite hall mark of the neurotic character. I am not arguing simply from the observation of a few coincidences among possibly unrelated series of variables. The association is a close one, and during the last few years I have seen it illustrated over and over again.

I wish, in conclusion, to refer to one point which is usually mentioned when the subject of tropical neurasthenia is under observation. That is the sex question. Sex, I believe, is one of those factors that will influence a person in accordance with the peculiarities of his own individual life style. Under tropical conditions the Englishman, especially the man to whom virility is the essential symbol of manhood, may find that conflicts are provoked which may not have their counterpart under the conditions of his life at home. It is not uncommon, for example, to find unmarried men who, during their leaves in England, take up their life as they left it, with comparatively little thought of sex among the many interests that absorb their energies, yet during their period of residence in the tropics, especially under conditions of isolation and separation from their countrymen, find themselves possessed of an almost unbearable nervous tension which may find relief through temporary liaisons with native women—which may be endured as part of the penalty of tropical life—or which may endeavour to find a false solution or outlet in some form of neurosis. I am not suggesting that such a supervaluation of sex function is not to be found among the neurotically disposed in temperate climates. It can be seen in its most extreme form in English patients living in England. But in the tropics quite apart from climate, temperature, humidity, etc., with the addition of possibly exciting sounds, sights and smells, there are often such specially associated influences as unlimited opportunity, comparative secrecy, the absence of restraint in the way of offending local social prejudices, perhaps the example and suggestions of those similarly placed. And something else which I have already hinted at, which must, I think, be taken into account. To an individual not too certain of his own masculinity, living in the midst of wild, primitive and possibly warlike peoples, intercourse may mean specifically the convincing assertion of manhood and the consolidation in symbol of his position of power and authority.

I have referred to only one instance of special conflicts in the sphere of sex engendered by life under tropical conditions. There are of course many others, such as, for example, the whole series which may have their origin in constantly recurring separations between husband and wife—possibly for long periods—which it may be impossible to avoid but which may be taken and made use of in accordance with the individual's plan in life or to fit in with his possibly unconscious strivings.

Dr. MURDO MACKENZIE: The diagnosis of tropical neurasthenia depends on the isolation of a clinical entity neurasthenic in type and conditioned by the tropics. The following cases suggest that the tropics can condition any form of mental disorder.

A junior civil servant went to Ceylon under difficult conditions. His work, domestic affairs and social life were complicated by his personal shyness, insufficient means, and lack of adequate qualifications. The tropical climate precipitated neurasthenia. Investigation in hospital at home showed that the patient was suffering from an obsessional neurosis from which he ultimately recovered.

A young woman who had previously lived in an easy social environment joined her husband in Africa. Isolation and fear of the natives brought on insomnia. She took to alcohol in excess and developed signs of alcoholic delirium. She returned home and examination in hospital resulted in the diagnosis of a hypomaniacal condition from which she recovered.

A middle-aged man suffering from "war neurasthenia" went to the tropics and was sent home with tropical neurasthenia in addition. In hospital he used the term "neurasthenia" to account for his condition, believed himself to be the victim of circumstances and demanded constant consideration. It became apparent that his illness was a cloak for a paranoid state from which he did not recover.

A typical neurasthenic state was seen in one patient. Subsequent examination and investigation showed that he was suffering from dementia paralytica.

It is probable that investigation of many other cases of tropical neurasthenia will reveal a different diagnosis.

It has been suggested that neurasthenia is seen in the depressed phase of the manic depressive disorder. This is not supported by clinical evidence, since the same state is seen in the apathetic phase of schizophrenia.

Tropical neurasthenia has disappeared to vanishing-point under the critical eye of Professor Culpin. It is to be hoped that "home neurasthenia" will soon undergo a similar investigation and suffer the same fate.

Dr. MANSON-BAHR said that he was very loath to give up his old friend "tropical neurasthenia"; but quite obviously it had to be given up. In conceding this point he did not wish it to be understood that he did not regard neurasthenia and its study of the greatest possible importance in the practice of medicine in the tropics. From the figures that he had been able to obtain and as a result of his own experience as Consultant to the Colonial Office, he thought that fully 30% of the invalidings from Tropical West Africa were due to this cause. It was somewhat of a paradox that tropical diseases no longer figured us a major asset in Tropical Medicine. It almost seemed as if, in the future, the School of Tropical Medicine would have to include in its course the study of psychoneurosis in the tropics, He agreed that the search for some agent of infection in these neurasthenics was usually a waste of time; the cause of the condition was much deeper than anything the microscope could reveal. The man suffering from dysentery was forced by circumstances to brood upon his digestive tract; the man who had suffered from malaria would brood upon the fevers and their effect upon his mentality, and the dietetic factor in the tropics had a quite definite effect on the mentality of some people.

A point that had not been stressed enough by other speakers was the monotony of tropical life—the eternal sameness of the day—the twelve hours of daylight alternating with twelve hours of black and pitchy night. When once a man had begun to sleep badly, as so frequently happened with even the sanest of these individuals, the seed of the trouble had been sown, because the fear of sleep increased as the term of service in the tropics drew to its close. Everyone was agreed that neurasthenia was very frequent in tropical countries and he had always been under the impression that the rate was higher than in the City of London; but what he would like was some criterion by which it was possible to forecast whether a man was of the type to develop neurasthenia—a potential neurasthenic. He had seen men of the best physique, University athletes, such as one would expect would be the very kind to undertake Imperial responsibilities, break down after their first tour, and he was indebted to Professor Millais Culpin for having helped him somewhat in being able to assess the psychological factor in candidates for the Colonial Service. A mental dissection of our future administrators in the tropics was every bit as important as a physical examination.

Sir MALCOLM WATSON said that he had lived for twenty-eight years in the Malay Peninsula, where the daily maximum temperature was 90°; and humidity was very high. There was the usual noisy population of bull frogs, mosquitoes and cicada.

In the first few of these twenty-eight years there had been a high death-rate from alcoholism and from suicide, following depression due to the combination of malaria and alcoholism. The sequence of events was (1) continual reinfection with malaria, leading to (2) great weakness which made physical exertion almost impossible, and (3) mental depression consequent on the continual malarial and physical weakness, (4) the alcohol habit acquired because alcohol in small doses relieved the sense of mental and physical weakness.

Much had been said about the prejudicial effect of white men living with native women. When he went to Malaya, probably 90% of the men in out stations lived with native women, who supplied the only companionship which these men had, often from one week to another. They were, in fact, helpmates without whom many more of the men would have succumbed to both alcohol and malaria.

These men were not "wasters"; they were the pioneers of the Empire, tried up to—or beyond—the limits of human endurance. They were the men "in the front line trenches," where a high casualty rate was inevitable.

In the early days it was difficult for white women to live in many parts of Malaya. Unlike the native women, they had no immunity or even partial immunity to malaria. As malaria

got under control, there were large areas where the health was excellent, and white women then came into the country in large numbers, lived happy lives and had healthy children. Just before he left only 2% of the men lived with native women.

Nevertheless, diseases of the nervous group, though changed in type, were by no means uncommon. There were a number of men who suffered from irritability and anxiety which exhibited itself in difficulties with labour forces, and worry in matters connected with the management of their estates. In the same way a number of women suffered from irritability and were "unreasonable" in the home.

Fortunately at an early stage he realized that these nervous conditions could be prevented by an annual change or holiday to one of the hill stations. The minimum holiday he recommended was two weeks, but three weeks was preferable. Such a holiday was, in his opinion, imperative for women after confinement. In Malaya four years was the maximum period that a man should spend without a return to a temperate zone; its hot, damp climate was prejudicial to the human race whatever might be the case of the drier tropical and and subtropical zones of Australia.

In order to live successfully in Malaya it was necessary to lead an active life. The activity for men in offices should take the form of golf or tennis, or some similar game.

Immediately after the late war, there had been many cases of tropical neurasthenia amongst men on whom special responsibilities had been thrown during the war owing to their estates being shorthanded. After the war, tropical neurasthenia still persisted among those who could not adapt themselves to the life he had described. Other cases occurred among women who missed amusements to which they had been accustomed and among men of a similar type. It was from this type of man and woman that the neurasthenias would come.

These were the effects as he knew them. He did not pretend to have a knowledge of modern psychology, but he hoped that from these, and similar facts which would be gathered in time, Professor Culpin and other psychologists would be able to arrive at some scientific conclusion, and give further help in the prevention of these disabling nervous diseases.

Dr. DAVID FORSYTH said that just as in this country it had been usual to label most kinds of neurotic and psychoneurotic conditions "neurasthenia," and now neurasthenia was known to be comparatively rare, so it should be realized in tropical practice that though neurotic conditions abounded, few of them were cases of neurasthenia. There was at present no ground for the supposition that life in the tropics included any peculiar factor in the production of neurotic trouble which was not to be found also in the social life of temperate countries. There was an aspect of the subject which had not been referred to in Professor Culpin's paper or in the subsequent discussion. He (the speaker) had had the opportunity of seeing a fair number of cases of men invalided home from the tropics on account of nervous breakdowns, and he had come to inquire in these cases what had led the patient to select a life abroad instead of remaining at home as did the vast majority of young men. He had been interested to find in every case a history showing that the patient was the subject of some neurotic or temperamental infirmity before going abroad. Three such types were specially common. First, young men who were "negative" to life, and as a result of an antagonistic and quarrelsome disposition, went abroad in the hope of finding more agreeable conditions. Second, those with an inferiority complex, who thought they might escape this disability by passing their lives in what they anticipated would be a more primitive state of society. Lastly, and commonest of all, young men who suffered from shyness to a morbid degree, especially in the presence of women; these, too, hoped to find relief in tropical stations remote from white women. In each of these types the neurotically constituted individual availed himself of the opportunity of going abroad as a flight from the strain of social life at home. It need hardly be added that this expectation was rarely, if ever, fulfilled, the individual inescapably taking his neurotic disability with him. From this it might be anticipated that Englishmen working in the tropics would, to this extent, comprise a rather higher percentage of neurotics than was found among those at home. Further, these considerations provided yet another reason for the psychological examination, in addition to the physical, of all men proposing to take up governmental and business posts abroad.

Professor CULPIN (in reply) said that Dr. Manson Bahr's difficulty illustrated the need for systematized instruction so that those who were called upon to decide questions of

psychological fitness should know what they were dealing with. The fitness of white races to survive in the tropics had been often affirmed and denied. The chief population of tropical Queensland was not in the drier inland but in the rain-forest area that had annual rainfalls up to 100 inches; the people flourished individually and socially. Dr. Forsyth's suggestion was new to him, but he thought that such self-selection did occur.

Section of Urology.

President—HUGH LETT, C.B.E., F.R.C.S.

[*February* 23, 1933]

Bilateral Urinary Calculi.

By J. SWIFT JOLY, F.R.C.S.

ABSTRACT.—Cases in which stones are found on both sides at the same time are alone considered. They form 9·4% of the admissions for stone in the upper urinary tract at St. Peter's Hospital. Figures from Continental clinics vary from 11% to 14%, while those obtained from post-mortem records are nearly 50%.

Four groups of cases are considered: (1) Calculi due to a special diathesis, e.g., cystine stones. (2) Aseptic bilateral calculi. (3) Infected bilateral calculi. (4) Cases complicated by anuria.

(1) Cystinuria should be treated medically, by diet and alkalis, but stones may form, in spite of treatment. They can be passed easily, and operation is only indicated when impaction occurs.

(2) The calculi are comparatively small, and it is rare to find more than one on each side. If the renal function is approximately the same on both sides, simultaneous removal is advisable. When this is impossible, the interyal between the two operations should not exceed fourteen days. When the function is unequal, the first operation should be performed on the more damaged kidney.

(3) When both sides are infected, the calculi are often very large, and the kidneys severely damaged. Infection is usually the primary factor, but its source cannot always be determined. The symptoms are slight, often merely persisting pyuria. If the value of both kidneys is the same: (*a*) no operation may be possible; (*b*) pelvic stones should be removed; (*c*) "stag horn" calculi are best left alone, unless there is evidence of fluid distension of the kidneys. When the function is unequal, an absolutely useless pyonephrotic kidney should be removed or drained, but if urine is secreted by both it is advisable to operate on the better kidney first.

(4) In cases of calculous anuria, the obstruction is usually found in the upper portion of the ureters. An attempt should be made to relieve it by passing ureteric catheters. If it fails, or if the anuria recurs, immediate operation is necessary. The kidney last obstructed should be drained. The stones should be removed as soon as the effects of the anuria have passed.

THE occurrence of stone in both sides of the urinary tract is always a source of grave danger to the patient, and presents many difficult problems to the surgeon, especially with regard to treatment.

Definition.—I shall consider to-night only cases in which calculi are present, either in the kidney or ureter, on both sides at the same time. It may seem hardly necessary to insist on this point, but I find many continental writers include among their cases of bilateral stone patients who had a unilateral calculus followed at some later date by a recurrence on the opposite side. For example,

Brongersma includes among his thirty-six cases of bilateral stone six cases in which the opposite kidney was considered to be healthy at the time of the first operation. Such cases are excluded from the present discussion. This is probably the reason why the proportion of bilateral lithiasis is smaller among our patients at St. Peter's Hospital than at most of the continental clinics.

Frequency.—During the decade 1915-24, 165 patients were admitted into St. Peter's Hospital on account of stone in the kidney; in thirteen of these both sides were involved, i.e., 7·9%. During the years 1926-32 (both inclusive) there were 280 admissions for stone in the upper urinary tract, which includes twenty-six admissions for bilateral calculi—9·4%. On the other hand Brongersma found thirty-six cases of bilateral stone out of a total of 244 = 14·8%. If his figures were corrected so as to include as bilateral cases only those of simultaneous involvement of both sides, the percentage would be 11%. Israel found bilateral stone in 11·2% of 572 cases, and states that Fedoroff found 13·2% in 241 cases, and Rovsing 14·2% in 589 cases. On the other hand, Legueu in 1891 obtained much higher figures. In his series of seventy-four cases, the lithiasis was bilateral in thirty-four. It should, however, be remembered that most of them were post-mortem findings, and that at that time radiography had not been introduced.

Classification.—Cases of bilateral lithiasis fall naturally into four groups, which I shall consider separately.

(1) Cases in which the calculi are due to a special diathesis, e.g., cystine stones. (2) Cases of bilateral aseptic calculi. (3) Cases of infected calculi. (4) Cases complicated by anuria.

It is impossible to lay down any hard and fast rules regarding the treatment of bilateral lithiasis as a whole. The problems presented to the surgeons differ so much in these different groups that they must be considered separately.

Cystine Calculi.

These stones always tend to be bilateral, and to recur after operation—so much so that some surgeons do not advise interference. The treatment is mainly medical, and its aim is to reduce the amount of cystine excreted in the urine and assist its elimination. The first is effected by cutting down the protein in the diet as far as possible, and the second by giving alkalis. This, however, does not always prevent the precipitation of cystine in the urine. I have found crystals of cystine in the urine of a patient who had been taking 120 grains of bicarbonate of soda every day for years.

Cystine stones, if small, are easily passed. They do not tend to stick in the ureter. On the other hand, they grow very rapidly, and may become impacted in the renal pelvis. In this case operation is necessary to preserve the function of the kidney.

Male, aged 22. First seen in January, 1920. Had been quite well till Christmas Day, 1919, when he had a right renal colic. A week later passed several calculi, the largest the size of a small pea. Cystoscopy two days later showed the right ureter dilated, irregular and surrounded by ecchymosis. Left ureter apparently normal. Skiagram showed great mass of calculi in left kidney. No stone shadows in right kidney or ureter. Left nephrolithotomy. Calculi composed of cystine.

Next seen in July, 1924. Stated that he began to pass stones about six months after the operation, and had passed them frequently ever since. In one week he had eliminated fourteen. For the last two or three weeks had had rather severe fixed pain in the right side. Had been taking insufficient amounts of alkalis, as his urine was acid, and contained numerous cystine crystals. Put on 120 gr. of bicarbonate of soda a day. Skiagram showed small, wedge-shaped stone in right renal pelvis. Round shadows in left renal area, largest about the size of a pea. It was thought that patient could pass the left calculi naturally, but that the right should be removed to save the kidney. Right pyelolithotomy.

Next seen November, 1932. Had not passed any more calculi. Has had pain in the right side intermittently for a year, and occasionally slight irritation on the left side. Otherwise well. Skiagram: Great mass of stone filling renal pelvis, middle and lower calyces right side. Six shadows—left renal area, probably calculi in calyces. Pyelograms: Right side, marked dilatation of upper calyx; lower and middle calyces and renal pelvis completely filled with calculi; left side, calculi (seen as filling defects) in middle and lower calyces. Urine from both sides sterile. Urea concentration: right, 1·2%; left, 1·4%. Blood-urea 34 mgm.%. Urinary sediment contained a few pus cells and red blood cells and crystals of cystine (urine was strongly alkaline).

9.1.33: Right nephrolithotomy. Recovery uncomplicated. For re-examination in three months' time.

I hope that this man will be able to pass the stones from his left kidney, but I do not think an operation on that side is indicated unless signs of obstruction arise.

Cystinuria is an incurable condition. The tendency of stone formation may be diminished, or even arrested, by a suitable diet, combined with large doses of alkalis. So long as the renal pelvis is not obstructed by a wedge-shaped calculus no operation is needed, as rounded or oval stones can be passed, even when they are comparatively large. An obstructing calculus must be removed in order to preserve the kidney. In these cases, surgery only prolongs life; it cannot cure the patient.

Bilateral Aseptic Calculi.

In these cases the stones may lie either in both kidneys, both ureters, or in the ureter of one side and the opposite kidney. As a rule they are comparatively small, and it is rare to find more than one calculus on either side. These are, in my opinion, the easiest cases to deal with, as operation gives the best results. On the other hand the outlook is hopeless if no operation is performed.

Female, aged 45, married, four children, eldest 20, youngest 10. Seen 18.11.24. Stated that she passed stones after the birth of each child. Was examined by X-rays in 1915, and small triangular shadows were found in the region of each renal pelvis. No operation was performed as patient's husband was at the front. She suffered from attacks of pain, chiefly on left side, but occasionally on right. Examined again by X-rays in 1922, and told that "no operation was necessary as the shadows had not increased in size." Noticed that her sight had been failing for a month, and had had several attacks of occipital headache during this time.

Examination.—Systolic blood-pressure 275. Urine contained two parts per 1,000 of albumin (Esbach). Deposit: A large number of hyaline and finely granular casts. A few epithelial cells from renal tubules and from pelvis. An occasional leucocyte. No blood or organisms. Urea concentration test: Before draught 0·7%, 1·6%, 1·6%, and 2·2% for the first three hours after it. Catheterization of ureters. Right side 0·9% urea, left 1·1%. Both sides sterile. Eyes: Patches of degeneration in both retinæ; old hæmorrhage in right. Abdomen: Left kidney palpable but not enlarged; right not felt. Very little tenderness on either side.

Patient became uræmic and died two months after examination.

In this case I feel certain that the nephritis was the result of the lithiasis, and that the patient's life could have been saved if the stones had been removed when they were first diagnosed. It was most unfortunate that she was told that an operation was unnecessary because the stones were not increasing in size. Cessation of growth is, to my mind, an absolute indication for operation, as it indicates that the kidney is either failing, or has become functionless. It is serious in unilateral lithiasis and of vital importance in bilateral.

In discussing treatment we must consider two types of cases. In the first, the function of both kidneys is approximately equal, in the second, one kidney is doing more work than the other.

If both kidneys have approximately the same excretory value, it is best to remove all the stones at one sitting, or if this is impossible, to operate on the second side ten days or a fortnight after operating on the first. If both calculi are in the pelvic portions of the ureters they can be exposed and removed through a single median incision. If they lie in the lower lumbar portions two anterior incisions are necessary. I prefer oblique muscle-splitting incisions, the position of which depends on that of the stones. If the calculi lie in the extreme upper end of the ureter, or in the renal pelves, the patient is placed on his face and oblique lumbar incisions are used. When it is necessary to make two incisions, the surgeon should operate on one side, while his assistant operates on the other. If one stone lies low down in the ureter, and the other is in the renal pelvis, the ureteric calculus should be removed first, and that in the renal pelvis at a subsequent sitting. Otherwise the patient's position must be changed, and the operation is prolonged unduly. Another indication for operating in two stages is when one stone is considered, either on account of its position or size, to be unsuitable for pyelolithotomy. It is very unusual for both to be unsuitable for this operation. I would then do the less severe operation (pyelolithotomy) first.

If the function is distinctly worse on one side than on the other one should operate on the less efficient kidney first. Such a procedure is, I believe, better than simultaneous operations on both sides. A stone in the ureter usually does more damage to the kidney than one in the renal pelvis, and should therefore be removed first. It is often stated that the better kidney should first be relieved of its calculus in order that a nephrectomy may be performed when necessary on the opposite side. A nephrectomy is only necessary for aseptic stone when the kidney is completely destroyed, e.g., when it is a hydronephrotic shell. This condition can usually be diagnosed beforehand, even without the aid of pyelography. The surgeon will naturally cut down on the functioning one first.

My reasons for laying down these general rules are these: Physiologists have failed to demonstrate secreto-motor nerves in the kidney; the renal nerves are apparently entirely vasomotor. The functional activity of the kidney depends on the amount of waste products in the blood; an increase in the amount of these products is accompanied by an increased excretion. This is the basis of the urea concentration test. If one kidney is rendered functionless by obstruction its fellow takes on most of the work of excretion, and becomes hypertrophied. Relief of the obstruction will, in this case, not be followed by resumption of functional activity, as there is no accumulation of waste products in the blood, and the kidney is not stimulated into activity. If both kidneys are partially obstructed, and both sustain the same amount of damage, a simultaneous relief of the obstruction will be followed by a simultaneous and equal improvement in function. If the obstruction is only relieved on one side, that kidney will improve rapidly, and relief of the obstruction on the other side at a later date will only be followed by a slight improvement of function. In these cases the kidneys will have unequal excretory values after the operations. Lastly, if one is damaged more than its fellow, operation on the better kidney will accentuate the difference in the functional value, while operation on the organ most affected will diminish it. To secure ultimate equality of function, one should operate on both sides simultaneously if both kidneys are equally damaged, and on the worst kidney first when the amount of damage is unequal.

It is hardly necessary to add that in all cases the operation should be done as soon as possible, as these patients run a grave risk of anuria from complete bilateral obstruction.

Bilateral Infected Calculi.

Infection may precede or follow stone formation. If the kidneys become infected after the calculi have formed, one finds that the central portion of the stones

are composed of calcium oxalate, xanthine, or some other salt which is usually precipitated from sterile urine. Such a nucleus may only be present on one side, showing that a unilateral lithiasis was followed by a bilateral infection. If, on the other hand, infection is the primary factor, no such aseptic nucleus is found.

It is difficult to determine the proportion of cases in which infection is primary, as that would mean sectioning all the calculi present on both sides, and that examination has rarely been made. My impression is that in most of the cases of infected bilateral calculi met with, in this country at all events, the infection is the primary factor. Out of 32 cases collected from St. Peter's Hospital and from my private practice, eight were uninfected, one had a unilateral infection, and 23 a bilateral. In the case of unilateral infection the lithiasis was obviously primary, but in the 23 cases in which both kidneys were infected I could only find evidence of primary stone-formation in two. In neither of them was the evidence conclusive.

In 15 of these cases the urine from both kidneys was cultivated, with the following results:—

Staphylococcus albus, three cases.
Staphylococcus aureus, one case. (A few coliform bacilli were also present on one side.)
Streptococci, two cases (one had a few diphtheroids on one side and the other was a case of unilateral infection).
Mixed growth of staphylo- and streptococci, one case.
Bacillus proteus (pure growth), two cases.
Bacillus coli communis, three cases (one had a few diptheroids on one side).
Bacillus coli communis and staphylococci, one case.
Bacillus fæcalis alcaligenes and staphylococci, one case.
Streptococci on both sides, with *Bacillus proteus* on one side and atypical *Bacillus coli communis* on the other, one case.

Five of these cases had been operated on elsewhere before they came to St. Peter's Hospital, but the bacteriological findings in the operated and non-operated cases were similar. It will be noticed that cocci were present in 10 out of these 15 cases.

Ætiology.—It is only necessary to discuss under this heading the origin of the infection. As a matter of fact one obtains very little evidence as to the source of the infection by reading the histories of these cases. In only two of them was there any important ætiological factor. One had a septic compound fracture of the humerus (a war wound), for which he was kept in bed for seven months. In the other the infection had probably begun in his bladder. The first patient had stones in the right ureter and left kidney, with bilateral pyonephrosis. The ureteric calculi were removed, but the patient died from uræmia on the ninth day. The second case is of interest as it shows how inveterate these urinary infections often are.

Male, aged 50. Admitted 12.3.28. Had an acute attack of frequency of micturition, with fever and hæmaturia in 1917 (? acute *Bacillus coli communis* infection). Admitted to the local hospital. Bladder opened, nothing found. Sinus remained open for eleven months. 1918, litholopaxy at St. Peter's Hospital. 1919, large branching calculi found in both kidneys. Right nephrolithotomy, left pyelolithotomy. Attended the out-patient department for nine years. Both kidneys severely infected. For three months constant aching in left loin, and occasional attacks of pain in right. X-ray examination: Large branching calculus left side, and five small stones right. Catheterization of ureters (after urea meal): Right: Alkaline; urea, 0·9%; pus and red blood cells; streptococci on films. Culture, bacilli of Proteus type. Left: Alkaline; urea, 0·4%; pus and red blood cells. Culture, coliform bacilli which do not ferment lactose. Calculus in left kidney removed by inferior nephro-pyelolithotomy. Recovery. Operation on right side refused. Written to 10.12.32: "General health poor. Weakness. Loss of weight. Headaches. Suffering from rheumatoid arthritis. No blood in urine. Occasional pain in right loin."

Hæmatogenous infections.—In many cases the patient is quite unable to put a date on the onset of the illness. He can only say that he has noticed the urine to be "thick" for a certain time, and often admits that it may have been "thick" for much longer, as its condition was only discovered accidentally. Other patients definitely date the onset, saying that the change in the urine followed a febrile attack usually diagnosed as influenza. Apart from pyuria, the symptoms are extremely slight. There is no pain, the frequency is not markedly increased, but there may be transient attacks of hæmaturia. In these cases the diagnosis is made by radiology, and the calculi are often very large. A urinary infection following influenza should be carefully watched, and if it does not clear up in a few weeks, a complete urinary examination should be made. It is perhaps more important to make a careful bacteriological examination in the early stages. One is too apt to assume that the *Bacillus coli* is always the infecting organism. This is by no means the case. If pyogenic cocci are present either alone or with bacilli, the prognosis is much more grave. These infections are, in my opinion, only curable in the early stages, and if allowed to persist are very likely to give rise to stone formation. When both kidneys are infected the calculi tend to be bilateral.

In another type of case the infection originates from a septic wound. Gunshot fracture of the femur, or indeed of almost any bone, is liable to be followed by calculus, and Paul has pointed out that the severity of the calculous disease is proportional to the severity and duration of the wound infection. Fractures of the lower extremity are more likely to be followed by stone than those of the upper. Prolonged immobilization undoubtedly plays an important part in favouring the formation and retention of these calculi. When the patient is lying on his back, the pelvo-calyx system of both kidneys is ill-drained, as the junction of the renal pelvis with the ureter is its highest point. This means that there is a certain amount of stasis combined with the infection.

Ascending infections.—It is well known that renal calculi are very common in patients suffering from fracture-dislocation of the spine, and that in a large proportion of cases they are bilateral. Müller found post-mortem bilateral renal calculi in eight out of ten cases of this nature. Bilateral renal calculi are also common in children suffering from spinal caries, tuberculous disease of the hip, and other conditions requiring prolonged immobilization. Dr. L. P. Pugh has told me that a considerable number of bilateral calculi are found in cases of this type at Queen Mary's Hospital for Children at Carshalton. In some cases stones were present on admission, while in others they developed while the patients were in hospital. They all had the same characteristics, in that they gave rise to few symptoms, except pyuria, they grew very rapidly, and quickly filled the pelvis and calyces. These patients live almost entirely in the open air, with the greater part of their bodies exposed to direct sunlight. It was found that calculus formation could be stopped by giving them large amounts of fluid, paying particular attention towards keeping the external genitalia clean, especially among the females, and by taking them indoors for two hours in the hottest part of the day. Since these precautions were adopted, no fresh cases of stone formation occurred in the hospital, although many patients were admitted with calculi. In most, if not in all, of these cases the infection must have been ascending, as very few had open wounds.

It might be expected that pyelitis of pregnancy would be a precursor of infected lithiasis. It is mentioned in the history of two patients, but in both these cases the urine from both kidneys was sterile.

Treatment.—It is difficult to lay down definite rules with regard to the treatment of infected bilateral lithiasis. Each case must be considered on its merits. The aim of the surgeon is not only to remove the stones, but also to cure the infection. In many cases neither can be done.

As a rule a ureteric calculus does more harm to the kidneys than one in the renal pelvis, and should be removed first. Similarly a pelvic stone is more dangerous than one in a calyx. It is generally a safe rule when calculi are present in different parts of the urinary tract to commence with the lowest, and to work upwards. One patient under my care had stones in both kidneys, the right ureter, the bladder and the urethra. I first cut down on the perineum and removed the urethral calculi, which were giving rise to a considerable amount of obstruction. I then dilated the posterior urethra and removed the vesical calculi. Three weeks later I performed a ureterolithotomy. The patient felt so much better after these two operations that he refused further treatment.

When stones are found in one kidney and the opposite ureter, those from the latter should always be removed first. The following case may serve as an illustration.

Male, aged 61. Has passed numerous stones since 1914. Last passed six weeks before admission. For one week severe pain in right loin radiating to groin, accompanied by vomiting. Has noticed marked diminution in amount of urine passed. No pain left side. Cystoscoped in out-patient department. Right ureter rigid and gaping, no efflux seen. Left ureter normal, good efflux. Right ureter catheterized to 28 cm. No urine withdrawn. ? right suppression. Admitted two days later.

Tenderness in right iliac fossa; abdomen otherwise negative. X-ray examination: Right ovoid ureteric calculus, 1 in. long, opposite transverse process of fifth lumbar vertebra; left side, triangular shadow 1½ in. by ½ in. in renal pelvis; group of small shadows about 1 in. external to it. Uroselectan-B; no shadow, right side, after forty minutes. Left renal hydronephrosis, good excretion in ten minutes. Both ureters catheterized to 25 cm. Good excretion left side, only a few drops from right. Both sides pus and Gram-positive cocci. Left urea 1·8%. Quantity from right too small for estimation. Blood-urea 60 mgm.%. Right ureterolithotomy. Stone just above brim of pelvis. Ureter about ½ in. in diameter. Uro-pus came away after removal of stone. Uneventful convalescence.

Re-admitted two months later. Well since last operation. Gaining weight. Uroselectan-B: Right side, good excretion in five minutes, outline of ureter and pelvis normal. Left side as before. Left pyelolithotomy, one large and six small stones removed. Normal convalescence. Stones from both sides phosphatic.

Seen five months after second operation. Backache at times, passing gravel. Urine sterile. X-ray showed small group of shadows, largest about 2 mm. in diameter, in both renal areas.

The most important points in this case are (1) the recovery of the right kidney and (2) the disappearance of organisms from the urine. The patient ought to be able to pass the remaining calculi naturally.

When infected calculi are found in both renal pelves, the treatment depends largely on their size and shape, and also on the functional value of the kidneys. One must consider separately (1) cases in which the function is approximately equal on both sides, and (2) those in which the value of one kidney is much better than the other.

(1) *Cases in which the excretory value of both kidneys is approximately the same.* (*a*) The renal function is so much impaired that no operation is possible. Example:—

Male, aged 56, was known to have a chronic infection of both kidneys in 1919. Radiogram then negative. Did not attend again till March, 1928. He stated that he passed several stones during the last five years. Never pain, frequency, or difficulty. Radiogram: Enormous triangular stone in right renal pelvis, calculous pyonephrosis left side. Cystoscopy, mild general cystitis, ureteric orifices normal. Intravenous indigo-carmine, no blue from either side in twenty minutes. Catheterization of ureters. Urine both sides, acid, purulent. Urea, in second hour after urea meal, 0·4% (both sides). Cultures: Right, *Staphylococcus aureus* and a few Gram-negative bacilli; left, *S. aureus*. Patient last seen July, 1928. No reply to "follow-up" letters.

(*b*) Renal function sufficiently good to permit of operation. The renal function never approaches the normal; it is always seriously impaired. The operation should therefore be as simple as possible. Stones casting large round or oval shadows can always be removed through a pelvic incision, as they lie in dilated kidneys. Definite triangular pelvic calculi should also be removed. When the stones are of the "stag-horn" type, filling the renal pelvis and the calyces, operation is rarely beneficial. An extensive incision through the renal parenchyma is necessary in order to remove them, and the kidney may be damaged so much by the operation that its function is temporarily abolished. As the opposite kidney is also defective, uræmia may follow. A careful study of the radiograms may enable one to decide if operation is possible. When the shadow of the portion of the stone in each calyx is distinctly club-shaped, with an expanded extremity and a comparatively thin neck, it is obvious that all the calyces must be slit up in order to remove the whole calculus. This operation does so much damage to the kidney that it is impracticable in bilateral cases. In these cases there is no fluid retention within the kidney. If, on the other hand, the portions of the stone lying within the calyces are not clubbed, and appear as rounded or finger-like projections, the calyces are dilated by fluid and extraction may be surprisingly easy. On the whole the operation is rarely possible when fully formed "stag-horn" calculi are present in both kidneys.

As a general rule, no operation should be performed when the stones are small. It is probable that they will be passed naturally. The patient should be carefully watched, and a radiogram should be taken every three months. If the calculi show signs of impaction, they should of course be removed. Another indication for operation in such cases is when there are a few calculi (not more than four or five) on each side, associated with a mild infection. The infection may clear up after operation, but it will not do so as long as the calculi remain in the kidneys. In these cases the operation is performed simply for the relief of infection. When operating on cases of bilateral infected stone, there is no indication to cut down on both kidneys at the same time. An infected kidney recovers much more slowly than one which is sterile. For this reason it is safe to leave a much longer interval between the operations, and I believe that an interval of from six weeks to two months gives the best results.

(2) *Cases in which the excretory value of one kidney is much better than that of the other.*

At one end of the scale we have cases in which there is a functionless pyonephrosis on one side, and a slightly infected kidney with a small calculus on the other. In such cases I think it best to remove the pyonephrotic kidney first. This is especially indicated when signs of septic absorption are present. Even in these cases a primary nephrectomy is preferable to a nephrotomy followed by a secondary nephrectomy. Of course the stone on the opposite side should be removed as soon as possible, as there is always a risk of calculous anuria.

When the patient's condition does not permit of a nephrectomy, either a temporary or a permanent nephrostomy is indicated. Any stones that can be felt when the kidney is opened should be removed, but a prolonged search for small fragments hidden away in the calyces should not be undertaken. The following case illustrates this condition.

Female, aged 59. Known to have had pyuria for five years. For six weeks severe pain in the right hypochondrium. Loss of weight and appetite. Constant thirst; drowsy in the day time. Right kidney enormously enlarged, extending down into iliac fossa, and inwards almost to middle line. Movable, tender on pressure. Left kidney not felt, very slight tenderness in left loin. X-ray examination.—Right side: Collection of large calculi, mostly separated from each other. Left side: Enormous branching stone, completely filling renal

pelvis and calyces. Cystoscopy: Moderate general cystitis. Right ureter: Thick pus coming away in worm-like masses at short intervals; left ureter: Efflux watery, but contains numerous purulent flakes. Intravenous indigo-carmine: No blue from right side, faint blue from left in twenty minutes. Catheterization of ureters: No urine right side, catheter blocked with pus. Urine from left side contains pus and a trace of blood. Urea, in second hour after urea meal, 0·8%. Cultures: A staphylococcus and *B. fæcalis alk.* both sides. Blood-urea 40 mgm. %.

Temporary nephrostomy (right). Calculi removed, as they were lying loose in pyonephrotic sac. Kidney contained almost a quart of pus. Drained and washed out twice a day. One month later, it was found that lotion used for lavage passed into bladder. Ureter dilated to 10 Charrière, and tube removed. Sinus closed in a week.

Did very well. Lived for two years and nine months in comfort, then pain in right side returned. Urine became very foul. Blood-urea 93 mgm. %. Frequency, half-hour by day and night. Died from uræmia ten days later.

When there is a possibility of removing the calculi on both sides I think it is usually better, in these cases, to operate first on the better side. It is probable that this kidney only will improve after operation, and one should give it every chance of doing so. If the opposite organ is later found to be functionless, it should be removed.

The prognosis in cases of bilateral infected calculi is naturally very bad. The infection usually persists, the stones re-form, and the patient is really in an incurable condition, although he may live for a considerable time. If the infection clears up after operation, the prognosis is much better, but even in these cases a certain amount of permanent damage is sustained by the kidneys.

Calculous Anuria.

One must distinguish between anuria caused by calculous obstruction and a terminal anuria due to renal failure. In the former condition, excretion is re-established as soon as the obstruction is removed; in the latter the kidneys are not obstructed, but are incapable of excreting urine. The former type of case alone comes under discussion.

It is obvious that in a paper dealing with bilateral stone I can only include cases of calculous anuria due to bilateral obstruction. There were two such cases in the thirty-two collected for this paper, and in addition one had anuria on one side. Cases of unilateral anuria are probably more common than one suspects, as the condition can only be diagnosed by cystoscopy. Clinically the absence of excretion on one side may be masked by increased function on the other.

In cases of calculous anuria due to bilateral obstruction the stones are usually found in the lumbar ureter. Eliot collected sixty-four cases belonging to this group. In forty-seven of these both ureters were obstructed, in eight there was a stone in one ureter and the opposite renal pelvis, and in nine there were calculi in both renal pelves.

The stones are usually small. It is rare to find the ureter obstructed by one larger than an orange pip. A pelvis stone is somewhat larger, but rarely exceeds a cherry in size. If a large branching calculus is found in one kidney, the surgeon should cut down on the opposite side, as large calculi are not obstructive. Many cases have been recorded in which obstruction was caused by collections of fine gravel, or of crystals, in the ureter. It is difficult to see how such a collection can give rise to complete anuria, but the following case is an example of it :—

Male, aged 62. Attended out-patient department 30.11.31, with a stone impacted in the fossa navicularis. The stone was removed. Patient stated that he had passed small stones or gravel frequently during the last seven years, and for a fortnight past had had pain in

the right loin. Returned 14.12.31. Pain much less. Cystoscopy: Ecchymoses round right ureteric orifice, no efflux seen; left side, normal efflux. X-ray examination: Elongated shadow low down in right side of pelvis, ? ureteric calculus. Round indefinite shadow on left side at level of sacro-iliac synchondrosis, rather outside line of ureter. Came to hospital 17.12.31, stating that he had passed no urine since examination. No pain. "Felt a little off colour." Bladder found to be empty. Admitted. Operating cystoscope passed. Lower end of right ureter slit up with scissors. Catheter passed to 25 cm., obstruction noted at 7 cm. Catheter left *in situ*. Blood-urea on admission 150 mgm. %. Drained 180 ounces of urine through catheter in next twenty-four hours. Urine contained blood and albumin, but was sterile. Blood-urea fell to 107 mgm. %. Catheter removed 19.12.31. Passed 12 ounces of urine that morning, followed by anuria for eight hours. Operation: Right kidney exposed, found to be large and congested, but otherwise normal. Renal pelvis filled with blood-stained urine. Pelvis incised and kidney explored, no stone found. Malecot tube stitched into renal pelvis. 20.12.31: Drained 70 ounces from nephrostomy tube. Condition improving. 21.12.31: Suddenly collapsed and died.

Post-mortem.—Large ante-mortem clot straddling bifurcation of pulmonary artery. Both kidneys large, externally normal. Both ureters obstructed by masses of soft gravel, on the right side in lower pelvic portion, on the left 2½ in. below uretero-pelvic junction. Site of operation satisfactory. X-ray shadows on right side caused by ossification of lesser sciatic ligament, on left side by an exostosis of ilium. Masses of gravel transparent to X-rays.

In this case, the shadow on the right side was thought to be thrown by a stone in the intramural portion of the ureter, until the ureteric catheter was passed. This was why the orifice was incised.

The second case is of interest on account of a curious error in diagnosis.

Male, aged 33. Gonorrhœa two years previously. Returned to V.D. clinic where he had been previously treated because his "water was thick." Pus and staphylococci found, but no gonococci. Treated with prostatic massage, irrigations, and vaccines. Given rest from treatment for one month. Two days later anuria set in; patient seen when this had persisted for thirty-six hours. Right kidney exposed, as patient had slight pain on this side. Stone size of grain of wheat found in ureter, at level of lower pole. Removed. Kidney drained. Radiogram taken a few days later showed a similar stone at same level in left ureter. Removed a fortnight after first operation. During this interval no urine was passed per urethram. Six weeks later, both kidneys acting well. Good elimination of indigo-carmine from both ureters in five and a half minutes after an intravenous injection. Urine sterile.

Patient kept under observation for six months; no evidence of urethritis.

The treatment of this type of calculous anuria is to re-establish the flow of urine as quickly as possible. Catheterization of the ureters is often brilliantly successful, but the surgeon must be prepared to operate (1) if the catheters cannot be passed above the obstruction; (2) if the urine does not drain freely through them, and (3) if there is a recurrence of the anuria when they are withdrawn. The indication for operation when the catheter cannot be passed above the stone is obvious. Urine may not drain immediately through a catheter that has been passed up to the renal pelvis, but it usually comes away in good quantity in less than an hour. If there is any delay, some writers recommend distending the renal pelvis with sterile saline solution. I think it better to give a diuretic or, if the blood-pressure is low, to stimulate the heart's action. I also feel that it is a mistake to re-insert a ureteric catheter if anuria recurs. I believe it is much safer to cut down on the kidney, and to drain it through the loin.

Two types of operations are performed for calculous anuria. The first are emergency operations with the object of providing efficient drainage. The second are set operations to remove the stones.

Emergency operations are performed when catheterization of the ureters is impossible, has failed, or is thought inadvisable. The surgeon cuts down on the kidney which he believes to be the more recently obstructed. Pain and muscular rigidity are the usual signs of recent obstruction. If they are not present, he must depend on the history of pain, or operate on the side which is most tender on pressure. In all cases he must be prepared to operate immediately on the opposite kidney if he cuts down on one that is disorganized, and obviously inefficient as an excretory organ. The operation is as simple as possible. The kidney is exposed, and the renal pelvis is incised. If a stone is found it is removed, but if there is none in the pelvis, time should not be spent in exploring the ureter. A self-retaining tube is inserted into the pelvic wound, and held in place by a single stitch of fine catgut. I prefer this method to draining the pelvis through an incision through the renal parenchyma.

Set operations are performed after preliminary drainage through ureteric catheters. The effects of anuria have passed off, the blood-urea is reduced to normal, and the position of the stones is determined by radiography. The surgeon cuts down on the stone and removes it. In these cases it is best to operate on both sides at the same time, unless the X-ray examination gives distinct evidence that one kidney is incapable of recovery, when a unilateral operation is obviously indicated.

In emergency operations the kidney last obstructed is drained. Its fellow has been blocked for a longer period. If, therefore, the surgeon decides not to remove the stones from both sides at the same time, he should commence with the undrained kidney. If this is not done, there is a risk that it may become permanently functionless.

Discussion.—Mr. JOHN EVERIDGE: Many of us observed during and after the war, cases of renal calculi amongst those requiring prolonged periods of recumbency through compound fractures of, e.g., the femur, tibia, etc. Reference has been made in the *British Journal of Surgery*, by Donald Hunter (1931 xix, 203), and others (*Ib.* 1933, xx, 479), to the incidence of renal calculi in destructive bone disease, viz., osteitis fibrosa, associated with parathyroid tumours. I am particularly interested in the incidence of stones in connection with another form of bone destruction, namely, tuberculosis of the spine, hip, etc. The recumbent posture necessitated by treatment is no doubt a large factor in production in this group, but I cannot help feeling that the setting free of calcium from the bone has possibly a share in the origin of calculus formation, although a hypercalcæmia appears not to be proven. At Queen Mary's Hospital, Carshalton, where I am consulting urologist, there are about 1,300 beds, a large number of which are occupied by cases of surgical tuberculosis. There is ample opportunity of considering this subject, and it has been interesting to study the development of these stones. A large proportion of the cases had been treated elsewhere and already had stones on admission. Such methods as have been adopted by Dr. Pugh, the Medical Superintendent, appear to have gone far to lower the incidence of stones, amongst which, increased intake of fluid, careful attention to the bowels (patients in these cases tend to be very constipated), frequent alteration of position by specially designed spinal and hip frames, and measures to counteract urinary sepsis when such is present, are noteworthy. In a number of cases radiographic opacities in the kidney regions have disappeared when forced intake of fluid has been established and, especially, when the child has been allowed to run about and resume a normal life; thus it is to be presumed that many of the shadows observed do not indicate formed calculi. Calculus formation remains a problem not yet fully solved, either in its origin, or in its treatment, in this type of orthopædic case.

Mr. H. P. WINSBURY WHITE: During the past three years I have had under my care thirteen cases of bilateral calculi in the upper urinary tract. I have operated upon nine of these with a modest amount of success in all cases. Three patients were advised not to have operative treatment, and a fourth case, although suitable for operation, I have lost trace of altogether.

A consecutive series of cases in this form of calculous disease offers examples of extraordinary interest, both from the point of view of surgical pathology and treatment. My cases are conveniently divided into certain groups:—

(1) Moderate-sized stones confined to both renal pelves (three cases). (2) On one side, extensive stone formation and destruction of kidney substance with infection, and on the other a considerable lesser degree of all of these processes (two cases). (3) Recurrent stones (five cases). (4) From one kidney, stones removed by operation; from the other, stones passed spontaneously (two cases). (5) Advanced calculous disease throughout both kidneys (three cases). (6) Calculus formation in one kidney after removal of stone from the other (one case).

Moderate-sized stones confined to both renal pelves.

(i) G. D., male, aged 10. A triangular stone, one inch in diameter, in the right renal pelvis with very slight dilatation and infection. Moderately good renal function on both sides. Pelvi-lithotomy on both sides, with six months interval. The left was done first, this was followed by prolonged pyrexia in convalescence. Calculus recurred later on left side. This in turn was removed. Satisfactory recovery.

(ii) B. P., female, aged 40. Triangular stones 1 in. by ½ in. in diameter in pelves of both kidneys which were considerably dilated and infected. Pelvi-nephro-lithotomy on both sides at six months intervals. Kidneys were drained at operation because of the dilatation and infection. Convalescence uneventful.

(iii) Mrs. J., aged 54. A stone the size of a filbert nut in pelvis of right kidney and one of the diameter of a halfpenny in left renal pelvis. A suitable case for bilateral operation, but patient refused treatment.

On one side, extensive stone formation and destruction of kidney substance with infection, and on the other a considerable lesser degree of all these processes.

(iv) L. A., female, aged 17. Masses of calculus throughout a disorganized and infected left kidney, which was apparently functionless. There was a branched stone 1¼ in. in diameter in the right renal pelvis and some infection of the kidney. Right pelvi-lithotomy was carried out. There was no recurrence up to twelve months later, when left nephrectomy was carried out. Great improvement in general health followed.

(v) H. P., female, aged 51. In the right renal pelvis a recurrent rounded stone 2 in. in diameter and several smaller stones. The kidney functionless and badly infected and giving rise to a lot of pain. Two previous stone removals from the right kidney with rapid recurrence. In left kidney two stones less than ¼ in. in diameter in lower undilated calyces. No infection on this side and function fairly good. One previous stone removal. Right nephrectomy. Stones were found to be secondary to a hydronephrosis with ureter adherent to renal pelvis. Marked benefit resulted to general health.

Recurrent stones: Cases (i) (v) (vi) (vii) and (ix).

(vi) M. W., female, aged 46.

Cystine calculi. A triangular stone commencing to branch, 1½ in. in diameter to right renal pelvis. Several smaller calculi in calyces. Very slight dilatation and infection. One previous stone removal. In left kidney two stones in calyces ¼ in. by ¼ in. in diameter, no dilatation or infection. Two previous stone removals. Right pelvi-nephro-lithotomy. Having regard to all the facts, no operative interference on the left side advised. Recovery.

(vii) L. T., female, aged 39.

About eight faceted stones, up to ¼ in. in diameter, in left renal pelvis. Two recurrent stones less than ¼ in. in diameter in calyces of right kidney. One previous stone removal from right side. Left pelvo-nephro-lithotomy. Recovery.

From one kidney, stones removed by operation; from the other, stones passed spontaneously.

(viii) H. L., male, aged 39.

Branched stone, 1¾ in. in diameter, in right renal pelvis, with infection, only slight dilatation and fairly good function. A stone the size of a pea in the upper part of the left ureter. Infection of the left kidney and no evidence of renal function. Right pelvi-lithotomy. Left stone passed spontaneously several weeks later.

(ix) G. B., male, aged 15.

Stone, ½ in. in diameter, removed from middle calyx. Some months later left-sided colic, followed by the passage of two stones. Six months later two more stones removed from right kidney. Has remained free from further calculi since (two years).

Advanced calculous disease throughout both kidneys.

(x) L. M., female, aged 52.

Large masses of calculi throughout both kidneys with poor renal function and infection on both sides. The general condition of the patient was not good and she was advised not to have operative treatment.

(xi) E. G., male, aged 38.

Branched stones in pelves and numerous smaller calculi in calyces of both sides with infection, but fair renal functional activity. Advised not to have operative treatment.

(xii) M. M., female, aged 63.

Stones in both pelves and widely through calyces. Poor renal function and infection on both sides. Constitutional signs of renal impairment. Advised not to have operative treatment.

Calculus formation in one kidney after removal of stone from the other.

(xiii) S. G., male, aged 40.

Stone the size of a filbert-nut in right renal pelvis, with infection and no dilatation. Right pelvi-lithotomy. Twelve months later an extensive dendritic stone occupying the pelvis and calyces was seen on X-ray examination of the left side. Patient elected to postpone operative treatment.

With regard to the question of which side to attack first: I like to begin on the better one, so that if on operating upon the second there is present some factor indicating nephrectomy, one can decide, after having actually handled the other organ, whether it is wise to follow this line of treatment. It is of interest to note in some instances, when stones occur in the calyces after operation, what little damage they may do and how slowly they may grow if the kidney is not infected and the calyces in which they lie are not dilated. This point is important in certain cases in which the patient, having had one or more operations on the kidney is anxious to avoid further operative interference. It is comforting to note in these circumstances that stones may be left with very little risk to the prospects of life.

In those advanced cases in which both kidneys are the seat of great masses of calculi, up to the present I have followed the rule of not undertaking any operative interference, but after hearing last year Dr. Cabot of the Mayo Clinic recount his experiences with regard to permanent nephrostomy in some of these cases, I cannot help feeling that it would be wisest to establish this form of drainage. This method of treatment seems all the more justified when one considers the otherwise hopeless outlook of this type of case. Another important application of nephrostomy in renal calculi cases is to drain the kidney for at least a week after the removal of stones when the kidney is dilated and infected. When I consider the anxious times I have had over certain cases upon which I have operated without drainage and compare it with the uneventfulness of the convalescence in those cases in which drainage had been carried out, I am convinced that the latter is the proper way to proceed.

The gravity of this disease is truly reflected in a study of my cases, for out of a total number of thirteen, five had recurrences; three had the disease so far advanced that they were advised not to have operation at all and one is constrained to give only a guarded prognosis in all cases which have been freed from lithiasis by operative means. This is especially necessary when a dilated and infected kidney is left behind, the two consoling factors being that many patients live for many years in spite of their complaint and that, wisely chosen, operative interference is of undoubted benefit.

Mr. E. W. RICHES said that the object of treatment in these cases was, wherever possible, to remove the stones and leave the patient with two kidneys.

[Mr. Riches showed slides illustrating three cases: in the first, in which a stone was impacted in each ureter, the better side had been operated upon first; within three weeks a large pyonephrosis had developed on the other side and had necessitated nephrectomy.

In the second there were large and small stones in both renal pelves; the better side had been treated first, the stones being removed and a temporary nephrostomy performed. Two months later the other kidney had been dealt with in a similar way with a satisfactory result.

In the third case a patient, who had painless pyuria, was found to have large branched calculi in one kidney and a single small stone in the other. He declined operation and had been treated by bladder lavage and urinary antiseptics for three years. He was still symptom-free and his renal function was good, indigo-carmine being excreted in four and a half minutes, even from the side on which, judging from a skiagram, it seemed as though there could be little kidney substance left.]

Section of Surgery.

President—HUGH LETT, C.B.E., F.R.C.S.

[*April* 5, 1933.]

Diaphragmatic Hernia.

By WALTER SALISBURY, M.S., F.R.C.S.

DIAPHRAGMATIC hernia in adults is sufficiently rare and serious to call for a report of every case. The following report of a case, with operative cure by the abdominal route, is therefore of interest.

History.—The patient was a clerk, aged 24. I performed the ordinary radical cure for left inguinal hernia, in Northampton General Hospital on March 4, 1929. Four days later the patient was attacked with retching, epigastric discomfort, and faintness, and the following day passed a black, tarry motion. A full inquiry was then made into his previous history with the following result:—

For two or three years he had suffered from sharp pain in the epigastrium, exactly in the mid-line, coming on before meals. He sometimes had nausea without pain immediately after meals. Vomiting had never occurred. The pain was always relieved by food or by bisurated magnesia. It was usually least when the patient was in the erect position and worst when he was recumbent. When the pain passed off it did so to the accompaniment of loud epigastric gurgling. The patient felt that vomiting would relieve him a good deal, but he had never achieved it. There was complete absence of flatulence and acid eructation. Appetite was always good and weight steady. Under diet and alkaline powders from his own doctor for eighteen months, there had been only temporary relief from pain. Periodicity, however, was well marked. Attacks of indigestion used to last from two to three months, with periods of freedom for three or four months. The bowels were regular and no previous attack of melæna had been noticed. There was no history of any previous illness, or of any injury or strain to the upper abdomen or chest. Even when suffering from indigestion he was particularly healthy in other respects and had played football and cricket during the previous year.

On examination.—He had a scaphoid abdomen and there was tenderness at a point 2 in. below the xiphisternum. No abnormal swelling was palpable.

Test meal (one hour): Free hydrochloric acid 0·248; total acidity, 79.

Skiagram after a barium meal showed a trilocular stomach (fig. 1, p. 16). This showed in lateral view only as when seen from the front the two upper locules were superimposed. The way these filled when the patient drank the barium was remarkable (fig. 2). When the barium reached the lower end of the œsophagus it ran uphill and filled the largest loculus from below upwards, then trickled over into the second loculus which it filled in like manner. Finally it passed slowly through the lower end of the second loculus and filled the third loculus, which was lying immediately below it.

FIG. 1.—Lateral view showing trilocular arrangement of stomach.

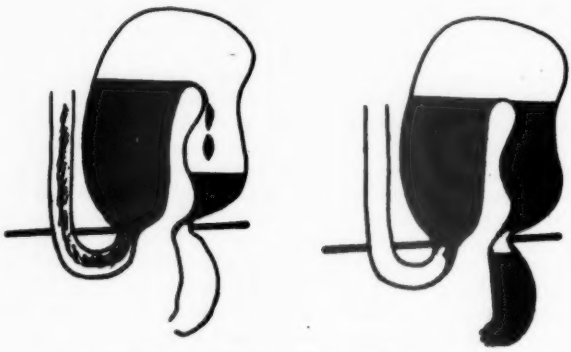


FIG. 2.—Diagram explaining trilocular appearance.

When viewed from the front (fig. 3), the stomach was seen on the left side of the heart. It reached the upper border of the eighth dorsal vertebra and four inches above the shadow of the diaphragm, with the patient standing. The radiographic diagnosis of diaphragmatic hernia was thus established.

Operation. April 11, 1929.—I made a left paramedian incision extending from over the costal margin to well below the umbilicus, and the rectus was displaced

FIG. 3.—Antero-posterior view. Note height of stomach above diaphragm and displacement of heart to the right.

outwards. This simple incision, when retracted laterally, gave perfect exposure and access to the diaphragm. The appearance of the upper abdomen was remarkable, as it was empty except for the liver and the portions of bowel emerging from the thorax (fig. 4). I withdrew the stomach from the thorax by traction on the greater curvature. When withdrawn from the abdomen, it was the largest stomach I have ever seen, and the greater curvature lay on the pubis. The whole length of the

duodenum showed very pronounced ileus. There was no sign of ulceration in the stomach or duodenum, nor any obstruction or kinking, and I believed that they would both fully recover if placed in their natural positions. The upper half of the small intestine reposed in the thorax and was easily withdrawn, as the bowel was collapsed. I then withdrew the greater part of the transverse colon and great omentum. On looking into the thoracic cavity I saw the spleen resting on the upper surface of the diaphragm in the angle between diaphragm and lateral chest wall, and with it the tail of the pancreas. These viscera were both withdrawn and appeared quite normal.

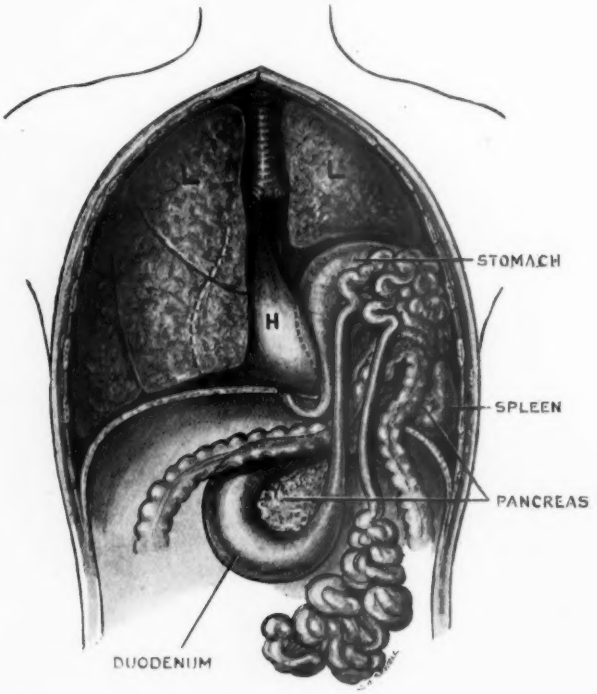


FIG. 4.—Diaphragmatic hernia as found at operation. Omentum and mesenteries are not shown.

The opening in the diaphragm (fig. 5) occupied the posterior part of the left cupola, was oval in shape and extended to within one inch of the œsophageal opening. The pleura and peritoneum were in one plane posteriorly, and were interrupted by a shelf of diaphragm anteriorly and bilaterally. The heart was seen beating. I passed my hand easily through the opening and felt the lung collapsed in the upper part of the pleural cavity. There was no hernial sac. The hole in the diaphragm was closed by suturing the anterior over the posterior edge on either side as in the Mayo operation for umbilical hernia, and where the posterior edge was deficient the sutures were passed through the muscles of the posterior abdominal

wall. This was done with eight mattress sutures of double catgut, and the parts came together without any tension or difficulty. The various viscera were then carefully placed in position and the abdomen was closed in the ordinary way.

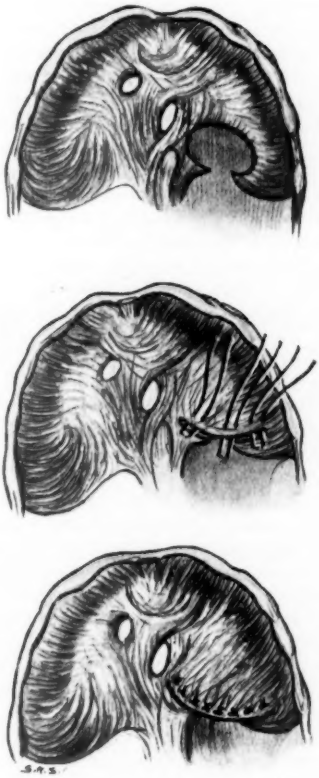


FIG. 5.—Diaphragm from abdominal aspect showing repair of orifice with eight mattress sutures.

Subsequent progress.—There was very little shock from the operation. On the following day the patient had two short attacks of hiccup and some pain in the left side of the chest. Apart from this, he made an uneventful recovery and was discharged on the twenty-sixth day. He was completely relieved of his symptoms and said he "felt a different man." He has been quite well since and has gained over a stone in weight.

COMMENTARY.

Symptoms.—Special features were:—

(1) Great similarity to duodenal ulcer with melæna, periodicity and relief by alkalis.

(2) Pain aggravated by recumbency and relieved by the erect posture.

(3) Relief of pain was often accompanied by loud epigastric gurgling.

Ætiology.—This diaphragmatic hernia was undoubtedly of the congenital type, as the pleura and peritoneum were in one absolutely smooth plane posteriorly, and it was evident that no diaphragm had ever developed at that place. There was a latent period of twenty-one years before symptoms developed. The large size of the opening made it less dangerous. It is not easy to explain what happened at this time to initiate the *chronic* symptoms. Possibly some posture or movement when playing games forced the spleen through the opening into the position seen at the operation, and the additional contents, as in other herniæ, produced symptoms. The onset of *acute* symptoms with melæna is more easily explained. Recumbency tends to have the same effect on a diaphragmatic hernia that standing has on an inguinal or ventral hernia, and it had usually aggravated this patient's symptoms. The recumbent position was adopted after the inguinal herniorrhaphy which I performed, and after four days of this the acute symptoms developed.

Operative methods.—The thoracic approach may be necessary when there are intrathoracic adhesions, but scarcely seems necessary in other cases and is certainly a more severe operation. Moreover, it is much easier to pass hollow viscera through an opening by traction from one side than by pressure from the other. I found the abdominal approach very satisfactory in every way, and the paramedian incision seems to me the ideal.

Recognition of diaphragmatic hernia.—Not nearly so many cases have been reported in this country as in America, and there can be little doubt that many cases are overlooked. How can this be avoided? I make the following suggestions, bearing in mind that the commonest symptoms are gastric:—

(1) In gastric cases, examine the left base for such signs as absence of breath-sounds in association with an area of hyper-resonance, and perhaps gurgling sounds, and possibly of splenic dullness above the diaphragm. In view of the large number of dyspepsia cases treated by physicians, the remembrance of diaphragmatic hernia as a cause of dyspepsia and the routine examination for these signs would probably lead to the recognition of more cases of diaphragmatic hernia.

(2) When making X-ray examinations in gastric cases special care should be taken to determine the level of the stomach in relation to the diaphragm, especially in the recumbent position.

(3) In operating for gastric or duodenal ulcer or other upper abdominal conditions, if the viscera are normal, then palpation of the diaphragm should be included in the surgeon's routine examination.

My thanks are due to Dr. W. M. Robson for the radiograms, to Mr. Ian Aird, F.R.C.S., my then house surgeon, for his excellent assistance and case notes, and to Mr. Sewell for the drawings.

Section of Epidemiology and State Medicine.

President—WILLIAM BUTLER, M.B.

[*March* 24, 1933.]

The Influence of Industry on Public Health.

By J. C. BRIDGE, M.R.C.P.E.

ABSTRACT.—Recognized specific risks of industry considered.

Under Section 73, Factory and Workshop Act, certain diseases contracted in a factory or workshop are notifiable by medical practitioners to the Chief Inspector of Factories.

Lead poisoning, epitheliomatous and chrome ulceration and anthrax—considered in detail.

Effects of inhalation of dust in the causation of silicosis and asbestosis. Relation of these diseases to tuberculosis. Reason to believe that a large number of dusts of different characters will create pathological changes in the lung.

Other diseases included in the Schedule under the Workmen's Compensation Act, e.g., nystagmus and dermatitis.

Common risks, i.e., shared by the general non-industrial population, incurred by workers.

Direct supervision of workers in industry.

The sphere and work of a works medical officer. The effects of National Health Insurance on such service. Co-operation between panel and works doctors. Far-reaching effects of the services rendered by works medical officers.

Periodic medical inspection under regulations for dangerous trades. Advice given on all medical matters.

The charge that industry raises the cancer incidence considered. Means of controlling early recognition and treatment include some non-industrial cases of cancer.

Anthrax in industry led to the introduction into the country of Sclavo's serum. Disinfection of wool protects the consumer.

First-aid training in factories gives protection in the home.

It is suggested that well-organized industry is a centre radiating the principles of preventive medicine.

I propose first to outline in general the recognized adverse effects of industry on the industrial population, and then to indicate in what manner and by what measures industry protects the health of workers from specific risks and also from maladies which may be termed common risks in that they are shared by the general public. I should say at the outset that my remarks must necessarily be directed particularly to industry as carried out in factories and workshops.

There can be no question that certain diseases are directly caused by poisonous materials handled in industrial processes, and with these I propose to deal first.

Some of these diseases are notifiable by medical practitioners to the Chief Inspector of Factories, under Section 73 of the Factory and Workshop Act—if they occur in a factory or workshop.

There are two causes of disease which stand out prominently in the table below, namely, lead, in the production of lead poisoning, and pitch, tar, and oil, in the production of epitheliomatous ulceration or cancer of the skin.

TABLE I.—REPORTED CASES OF INDUSTRIAL DISEASE OR POISONING.

Disease or Poisoning	1900	1910	1920	1930	1931
Lead Poisoning	1,058[38]	505[38]	289[44]	265[32]	168[21]
Phosphorus Poisoning	3	—	—	—	—
Mercurial Poisoning	9	10[1]	5	3	6
Arsenical Poisoning	22[8]	7	3	1	—
Carbon Bisulphide Poisoning ...	—	—	—	—	5
Aniline Poisoning	—	—	—	24	30
Chronic Benzene Poisoning ...	—	—	—	—	11
Toxic Jaundice	—	—	6[3]	—	7[2]
Anthrax	37[7]	51[9]	48[11]	43[6]	21[4]
Epitheliomatous Ulceration ...	—	—	45[1]	194[36]	156[45]
Chronic Ulceration	—	—	126	95	65

The principal figures relate to cases, the raised figures to deaths.

The largest number of the lead poisoning cases in any one industry—64 in number in the year 1931, out of a total of 168—occurred amongst those employed in the painting of buildings with lead paint. The number exposed to risk cannot be estimated. During the years 1900-1931 there were 1,736 deaths attributed to lead poisoning, most of them being ascribed to chronic nephritis. It is interesting to compare the mortality figures (in computing which the number at risk is considered) for chronic nephritis in various occupations; while file cutters stand first (a very small and diminishing group of workers), pottery workers, from which the largest number of fatal cases of lead poisoning are reported, are below textile workers for this disease. The inference would appear to be that non-industrial causes (or those not directly connected with industry) are chiefly responsible for the high mortality figures for chronic nephritis.

In 1931 there were 46 deaths notified from epitheliomatous ulceration due to pitch, tar, etc., and of these the lesion was situated in the scrotum in 26. There were 61 deaths from cancer of the scrotum in the whole population in the same year. A very high proportion, therefore, must be ascribed to industry.

Twenty-one cases of anthrax were notified in 1931, occurring among persons handling wool, horsehair, and hides and skins. This is rather less than in previous years, but of sufficient importance seeing the possibility of infection among the general population.

Chrome ulceration of the skin or of the mucous membrane, which also figures largely in the list, now chiefly occurs by reason of the desire of the public to have untarnishable metal surfaces, and consequently when chromium plating was introduced the number of cases of ulceration increased in number.

Of the effects of dust inhalation there is ample proof to incriminate that of quartz, SiO_2, and asbestos, producing in the one case silicosis and in the other so-called asbestosis. The numbers of cases of disablement and death from silicasis compensated in 1931 were 283 and 127 respectively.

There is, I think, definite evidence that fibrosis of the lung caused by the inhalation of dust of silica is particularly favourable to the tubercle bacillus and that the course of the tuberculosis in such cases is rapid. It is therefore obvious that the inhalation of this dust must influence the incidence of tuberculosis in the general population by occasioning fresh sources of infection.

With regard to asbestos dust and asbestosis, the effect of the tubercle bacillus on a lung affected with asbestosis is not at present so well established.

Of other dusts used as abrasives such as emery, carborundum, garnet, we cannot at present estimate their effect, and while no one would be willing to say that they do not produce some pathological changes in the lung of a fibrotic nature, it can at least be affirmed that they do not cause silicosis. We do not know, I submit, whether and to what extent a lung affected by these dusts is influenced by the tubercle bacillus, though one frequently finds a definite opinion expressed at inquests on this point.

There is evidence, further, as was shown in the inquiry by Dr. H. B. Hill into sickness among cotton cardroom workers, that dust from vegetable fibre present in certain processes in the cotton industry produces an asthmatic or bronchitic condition of the lung, which is of a disabling character, though, so far, clinically indistinguishable from a similar condition occurring amongst the general population.

There are also a number of other diseases which are the direct result of industrial employment, as the list of these diseases which are the subject of compensation under the Workmen's Compensation Act shows. Two from this list stand out very prominently, namely, nystagmus and dermatitis. There were 8,354 cases of nystagmus receiving compensation at the beginning of 1931, to which were added 2,729 new cases during that year. I have classed it "diseases," but it seems to me that nystagmus is merely one manifestation of an abnormal reaction to environment. I have no knowledge of its occurrence in factories, and it may be that if it does occur it is unaccompanied by the other manifestations which make the disease disabling.

With regard to dermatitis, the number of cases of which the Factory Department are aware, and the occupations in which they occur, are given in Table II. There will be seen in addition the number of cases which have been compensated during the year 1930. In 1931, 1,328 cases received compensation, and at the beginning of the year 351 were still receiving compensation for the disease acquired in 1930.

TABLE II.—DERMATITIS. OCCUPATIONS.

	1931	1930	1929	1928	1927
Dyers and Calico Printers	82	104	54	50	46
Engineers	90	102	114	108	81
Labourers	56	74	31	31	22
Metal Platers and Polishers	44	66	53	47	21
Bakers and Confectioners	56	58	50	58	33
French Polishers	42	50	40	45	38
Painters	29	40	86	46	18
Leather workers and Tanners	19	38	13	8	9
Chemical workers	35	31	58	37	52
Rubber workers	25	31	19	29	31
Sugar Confectioners	30	30	37	26	11
Metal workers	21	28	27	16	19
Textile workers	25	20	14	18	23
Oil Refiners	10	19	7	1	11
Printers	16	19	12	9	5
Sugar Refiners	12	13	9	15	7
Pottery workers	5	13	8	7	6
Flour workers	3	9	12	3	5
Biscuit makers	20	8	12	4	2
Total cases receiving compensation under Workmen's Compensation Act	1,679	1,802	1,665	1,367	1,029

During the year 1931 there were 755 fatal and 112,494 non-fatal accidents in factories and workshops. It is commonly thought that these accidents occur from machinery, but the number which arise from this cause is only about 20% to 25%. On the other hand, falls account for one-third of the fatal and one-eighth of the non-fatal accidents.

Accidents, from whatever cause, are a loss to the community generally. Not the least in affecting health is the reduction in the standard of living of dependants. I fear we in this country are falling behind other countries in providing means for the rehabilitation of persons injured in industry. The cost of such centres for rehabilitation would, I believe, soon be repaid by the reduction of the time lost in convalescence and by an increase in the ultimate efficiency of the injured person on his return to employment.

The aggregation of workers in crowded tubes and trams must, it is thought, inevitably lead to the spread of infection, and this is instrumental in increasing

epidemics. There are, too, from time to time, instances in factories where one suspects tuberculous infection, though the actual course is difficult to trace.

The common ailments ascribed to industry are diverse and their number numerous. The number of sickness claims by insured persons is undoubtedly high and appears to be on the increase, but it is important to bear in mind what Sir George Newman said in his report for 1931, i.e., that the apparent rise indicates an increase of claims rather than an increase in disease.

It is difficult to assess the part played by industry in the incidence of illnesses common to the general population, such as gastritis, bronchitis, rheumatism. Taking rheumatism alone—covering a multitude of afflictions—Glover, in his Milroy Lectures, showed that among steel workers this disease showed a heavy incidence (80% in excess of expectation). He suggests that such workers probably suffer more risk of chill from extreme ranges of temperature and trauma than other workers do, and that some of the heavy metal trades involve, sometimes perhaps needlessly, exposure to weather.

Turning now to the other aspect of my subject, I venture to put before you some ways in which, in my opinion, industry, either directly or indirectly, and in spite of all the processes carried on, is of benefit to the community at large from the point of view of preventive medicine.

One of the most important, if not the most important, seems to me to be medical supervision of workers. The direct medical supervision of industry is still a comparatively new idea. One thing which the world-war did, was to show the value of the co-operation of medicine with industry, beneficial to the workers and to industry itself. It is expressing a platitude to say that if every person could be selected for his work, both from a physical and psychological point of view, the effects of industry would be nothing but good. I hope that eventually in selection for employment both these points of view will be borne in mind, but we have a long way to go.

There are many difficulties to be faced, but I am sure progress is being made. Unfortunately, and I say it with all respect, we in this country are faced with a great handicap as regards the medical supervision of workers in industry. Our present system of health insurance is to require from the employer and employed a fixed sum every week to pay a doctor for treating the employee when he is ill. It will therefore be readily understood that an employer having to pay this annual sum is reluctant to provide medical supervision for his employees at work who are presumed to be well. It may be a short-sighted policy, but one cannot regard it as altogether unreasonable. Knowing what we know now, I wonder whether we should not have seen the advantage of some medical supervision in the works following the employee, in case of illness, to his own home. A letter in a recent issue of the *Lancet* from Dr. Howard Mummery seems to indicate what I have in mind. He refers to the advantages derived from co-operation between the works doctor and the panel doctor and the valuable results obtained from this. He stresses a very important point in view of the nature of many of the illnesses, namely the shortening of periods of absence of sickness by the works doctor.

Nevertheless, in spite of the difficulties I have alluded to, there are an increasing number of medical men attached whole or part time to works. It is not possible to estimate the effect of their work in the prevention of various illnesses and their sequelæ among the workers under their care, whether such illnesses are contracted inside or outside the employment matters not. They are, I venture to suggest, officers of preventive medicine in a very true sense of the word. Not only do they assist by all possible means in ascribing suitable work to applicants, but by keeping a watchful eye on the worker, distressed either in body or in mind (and mind is by no means a negligible factor), prevent such workers falling by the way and

becoming patients for the panel practitioner in an illness of unknown cause and uncertain duration.

It has been said that industry causes aggregation of workers and therefore is an important factor in the spread of infection, such as that of the common cold or influenza. It is true that workers are herded together in tubes, trams and 'buses on their way to work. I suggest that such aggregation is no greater, no worse, than is seen on a Saturday afternoon when the public in their thousands attend football matches, or in the evenings go to and return from the cinema or theatre. The conditions under which they work, so far as ventilation, etc., are at least to be preferred in many cases to those of a cinema or theatre. Indeed, I suggest that the conditions of employment in a vast number of cases compare favourably with many home conditions.

As to the specific diseases due to definite poisons, the occurrence of these cannot be denied, but it is important to remember that, except in one instance, viz., anthrax, they are not communicable to the general public. I am of the opinion that the methods taken for the prevention of these specific diseases prevent the occurrence of other illnesses, so that while protecting from a specific poison, they also raise the standard of general health.

The periodical examination of workers engaged in processes exposing to lead, for example, does, as a consequence, have an effect in preventing diseases apart from lead poisoning. If a septic mouth is really such a serious matter as we are led to believe, then I think the medical men examining lead workers are really carrying out preventive work of a substantial character. I am sure you would be surprised to see the number of edentulous workers in these processes as a result of this examination. And there are being established in works an increasing number of dental clinics, starting where a dangerous process is being carried on and gradually extending to all sections of the works. These are real preventive institutions catering for a population not at present otherwise provided for.

The charge as to the production of cancer is no light one, but even here, I think, industry is proving of value in its prevention. Firstly, I think I am right in hoping that the causation of cancer produced by pitch, tar, etc., is leading research workers to a better understanding of the cause of the disease. At any rate, by granting compensation to cases of cancer occurring in industry and considered to be due to industrial contact with tar, pitch, etc., it provides an incentive to obtain early treatment. There must be among these, if only a few, some who procure treatment although the disease is not to be ascribed to industry. Further than this, the medical examination of workers in the pitch and tar industry and in the shale works has proved a valuable means of preventing the occurrence of epithelioma in an advanced and inoperable state, whether it be primarily due to employment or not.

Compensation for the period during which treatment for the early stage of the disease can be obtained has now been granted to one group of workers—mule spinners—and its extension to others is now under consideration. Such a measure will tend to bring under observation and treatment at least a few early cases produced otherwise than by employment.

As to anthrax, to the best of my knowledge no case of transmission of the disease from one worker to another worker or to a person outside has occurred. This may in some measure be due to the close co-operation between the Medical Officer of Health and the Factory Department. Apart from that, however, the occurrence of anthrax in industry led to the introduction into this country of serum for the treatment of the disease. It is of interest to note that the late Sir Thomas Legge, after a visit to Italy in 1904, was so much impressed with the value of Sclavo's serum in the treatment of anthrax that he introduced it into this country. He brought back with him a supply of serum, which for some time was kept and distributed from the Home Office.

I might also draw attention to the Anthrax Disinfection Station, at which certain classes of wool are compulsorily disinfected, thereby not only primarily preventing the workers who handle the wool in the factories from becoming infected, but also the general public who subsequently purchase the manufactured articles.

It is interesting to record that as long ago as 1822, Mr. J. H. Abraham, of Sheffield, received a public recognition from the citizens of Sheffield for an invention to prevent lung disease among grinders. The invention appears to have been some sort of magnetic arrangement, judging by the following:—

> "The patronage of the Public is most respectfully solicited in aid of a subscription, for the purchase of a piece of Plate, or other article of home manufacture, to be presented to Mr. J. H. Abraham, as a token of the esteem in which his abilities, as the inventor of the Magnetic Apparatus for the use of Grinders, are held by his townspeople and neighbours. Mr. Abraham's claims to such an acknowledgment, at this time, are grounded on the following considerations:—
>
> "By a patient, ingenious, and scientific process of thought and experiment, attended with much pecuniary expense, as well as sacrifice of time and labour, in journeys and otherwise, Mr. Abraham perfected an apparatus, including magnetic guards, dust retainers, etc., to collect or carry off from the workman, the pernicious dust arising from dry grinding, which, if adopted generally, might be the means of alleviating, to a great extent, the excruciating disorders to which that useful class of people are exposed, and perhaps prolong their lives through years of comparative health and comfort.
>
> "Mr. Abraham, in the course of his investigation on this subject, made several curious discoveries, both respecting the properties of magnetism, and respecting the combination of iron and stone in the subtlest particles evolved in the process of grinding. The value of these may hereafter be duly appreciated by further experience; the sagacity of Mr. Abraham in detecting them has been acknowledged by some of the most eminent natural philosophers and chemists of the age.
>
> "The merit of Mr. Abraham's apparatus having been put to the strictest test by the Cutlery and Needle Manufacturers and Grinders at Sheffield, Hathersage, and Redditch, and afterwards repeatedly discussed in Meetings of the most Scientific Gentlemen of the Metropolis, he was finally complimented with the highest honorary award that could be granted by the Society for the encouragement of Arts and Manufactures, in the presentation to him of their gold medal."

There seems little doubt that the disease was considered to be due to the mineral particles in the dust—hence the name siderosis.

Conditions have been improved by ventilation and cleanliness, and the risk reduced by the substitution of artificial abrasives for the natural sandstone, the dust from which produces silicosis.

Compensation for silicosis and asbestosis and the periodic examinations of persons in processes exposing to risk, have gone even further. The initial and periodic medical examinations of workers have brought to light cases of tuberculosis. During the last year 37 new cases were referred to the tuberculosis officers—a measure of protection of no little importance in preventing the spread of infection among the general population.

It must be realized that industry is the servant of the public, and when we look at the figures for chrome ulceration, for example, we must remember that chrome-plating is a device to reduce labour and fatigue, always assumed, so far as I can judge, to be a most pernicious factor in domestic life. So that some 65 cases of chrome ulceration do not appear a very big price to pay for all the advantages in saving of labour and fatigue. I have no doubt that there are few of you here this evening who have not either the fittings of your car or your domestic water taps chrome-plated for the benefit of yourself, your chauffeur, or your domestic servant. If the public demand such privileges you must not be hard on industry if it produces a few cases of ulceration. Industry has taken steps to prevent as far as possible the

damage done to meet your demands, and the figures for notified cases of chrome-ulceration have fallen from 109 in 1929, to 65 in 1931.

A point of interest in connection with these cases is that the characteristic ulceration of the skin never becomes malignant in character, and while the dust of the bichromates—potassium and sodium—and the spray of chromic acid in chromium plating produce ulceration and perforation of the nasal septum, no sequelæ of an untoward character have been known to occur. It is incorrect, in my view, to describe this condition as "chrome poisoning" as is sometimes done, although one case showing an allergic action due to chrome was described in the *Lancet*, 1932, ii, 182.

If it is true, as I believe, that there is nothing used in industry which will not in certain individuals produce dermatitis, I do not think the number of cases can be regarded as excessive. If it were possible to prevent contact in every case by protective appliances such as gloves, the remedy is obvious, but it is not possible or safe in some cases to use that method of prevention. Even so, I venture to say that the measures adopted in industry to limit the incidence of dermatitis are not unavailing in protecting the health of the individuals.

Thus the initial examination and the routine inspection of workers detect early signs of all forms of skin diseases and the provision of washing accommodation promotes habits of cleanliness which cannot otherwise be inculcated. And lessons learned in the factory are, I suggest, conveyed outside the factory.

In this connection it is not inappropriate to refer to the first-aid work in industry. It is only seventeen years ago that first-aid of a definite character was required in the factories. While primarily catering for injuries received in the factory, there are undoubtedly numerous injuries received outside periods of employment which receive treatment and prevent more serious results. Large numbers of workers have received first-aid training and a number of women who have taken these certificates continue their education, with instruction in home nursing. Further, it cannot be suggested that the educational work of the "Safety First" Association, with regard to the early treatment of minor injuries in the factory is entirely forgotten outside.

I am afraid it is becoming more and more a habit to blame industry for every kind of illness common to the general public. It is therefore of interest to note that in the case of tuberculosis the increasing incidence among women has been ascribed by Tuberculosis Officers to fatigue and its consequences, produced, not by employment, but by the efforts spent in relaxation. Speaking generally, it is not my view that industry as carried out in factories or workshops adversely affects health; rather do I think that in many respects it exercises a beneficial effect not only on those actively engaged in it but also indirectly on those not so employed.

It is alleged, more particularly abroad I find, that industry is an important contributory cause in a high maternal death-rate. It is therefore encouraging to find in the Report by Dame Janet Campbell and others, on the high maternal mortality in certain areas, that under present industrial conditions there was little evidence to support this view.

Looking back, I think a future generation will consider that our chief cause of accidents and disease was due to increasing speed to which we were not accustomed. That generation will no doubt have acquired an appreciation of speed which we, except for a few notable exceptions, do not possess.

What further diseases may arise in industry I do not know. Changes occur from day to day, changes in methods of working and in the materials used, all of which may in the future, as they have done in the past, produce their different effects on the workers.

In conclusion I have the temerity to suggest that a well-organized factory is becoming increasingly a centre of preventive medical work of no little value to the community.

Discussion.—Dr. MILLAIS CULPIN said that occupational dermatitis might be influenced by two very different factors. A disabling skin condition might be kept alive by the patient even when there was no witting attempt at malingering. In addition, a parasitic affection of the skin, an epidermophytosis, well known in hot countries, had since the War become prevalent here. It might cause little or no trouble, but when the skin was mechanically irritated the infection sprang into activity. Dermatologists recognized it as the underlying cause of some recurrent occupational cases.

The heavy disability from miners' nystagmus was now recognized as due far more to the psychoneurotic elements of the disability than to the ocular. Reduction in the incidence might be affected by an informed handling of the individual case and, if feasible, by the exclusion of susceptible subjects from the occupation. Recent work under the auspices of the Industrial Health Research Board had shown the possibility of detecting such subjects.

The recent availability of sickness figures had brought to light both the high incidence of sickness due to psychoneurotic disorders and the likelihood that the incidence was always under-estimated because of such disorders masquerading under other diagnoses.

Dr. N. HOWARD MUMMERY said that he was not in favour of first-aid training in large factories where a clinic with a doctor and trained nurses was available, although its first principles should be inculcated by example and verbal advice to individual patients. In his opinion, the little knowledge that first-aid classes imparted was a dangerous thing under factory conditions, unless restricted to the simplest procedures, and he deprecated attempts to remove emery sparks from eyes with match sticks, or the application of advertised ointments to wounds and skin eruptions, before he saw the cases. On the other hand it was impossible to over-estimate the importance of training work-people by example in the essentials of personal and general hygiene, for not only was this necessary in a food factory, but it had a most beneficial influence upon their domiciliary lives and upon the physical fitness of the next generation. In his own work during the past ten years he had seen a most remarkable change in the hygienic condition of the work-people with whom he came in contact. Body parasites that used to be common were now conspicuous by their absence, and rigid insistence upon adequate dental treatment had resulted in healthy mouths and a reduction in the incidence of gastritis and fibrocytic infections. In spite of the prevailing unemployment there had been a steady general improvement in the physique and fitness of the working population in London, which was in marked contrast with what he had found in the factories, and among the people in general, in Germany in 1931. Dr. Bridge had well demonstrated the important part that his department of the Home Office had played in this improvement, and he had also given generous credit to medical supervision and welfare work in industry as contributory factors. But one must consider unemployment as an evil which tended largely to limit the beneficial effects of industry in spreading the principles of preventive medicine and hygiene, and anything tending to increase that evil called also for careful study. He therefore wished to call attention for a moment to an aspect of the case which was assuming grave proportions. The Workmen's Compensation and Employer's Liability Acts very rightly held the employer of labour responsible for injuries and diseases arising out of and in the course of a workman's employment, and from time to time the scope of these Acts was being extended, in accordance with the advance of medical knowledge, to cover more and more of the pathological conditions met with in industry. Unfortunately, however, the legal definition of what was, or was not, an industrial injury or disease in many instances appeared to be based upon previous rulings unearthed from the hidden limbos of legal archives rather than upon the pathology or merits of the particular case, and the legal machinery of industrial courts seemed in urgent need of overhaul and re-adjustment. Few who were not directly concerned had any appreciation of the burden upon industry that assurance against the risks covered by these Acts involved. Many large companies paid between £12,000 and £15,000 annually in premiums for such insurance and, as these premiums were based upon the average claims the assurance company had to meet, the employer still remained vitally concerned. Only recently the House of Lords had ruled that an employee who had died suddenly while at work from cardiac infarction secondary to progressive disease of the coronary arteries, had died from "internal injury by accident" although admittedly he had not been exposed to any particular strain. Equally the final rupture of an aortic aneurysm was an "internal injury" if it chanced to occur during the hours of employment. Such inequitable decisions must have a profound influence upon employers who tried to help the "lame dog," handicapped in the struggle for existence by

some physical infirmity, to find suitable employment. For in large industrial concerns all applicants for employment were examined by the firm's doctor who endeavoured to find jobs for many such men. At present he (the speaker) rejected only between 2% and 3% of applicants for work, but a more rigid selection of those physically fit would raise this figure to approximately 20%. He also saw from time to time old employees suffering from diseases common to advancing years, among whom were many with cardio-vascular degeneration which in the fullness of time would cause death which might be sudden and might occur at work. These people naturally wished to retain their jobs as long as possible, but the courts were making them a very serious liability in industry. He submitted that in the absence of competent medical evidence of causation or aggravation by employment the natural termination of progressive disease should not be termed an "internal injury" and a liability of the employer.

Dr. W. S. C. COPEMAN said that he wished to make a mild protest against the casual manner in which Dr. Bridge had spoken of rheumatic disease in industry. Of the total sickness benefit paid in this country by the Approved Societies, one-sixth—a sum of something like £20,000,000 a year—was paid on account of rheumatic diseases.

Section of Anæsthetics.

President—C. F. HADFIELD, M.D.

[*March* 3, 1933.]

DISCUSSION ON ANÆSTHESIA IN INTRACRANIAL SURGERY.

Mr. Norman M. Dott: During ten years' work in connection with cerebral surgery, the methods which I have employed have been: From 1923 to 1925, ether vapour by inhalation; in 1926 local infiltration with novocain-adrenalin was added to the general anæsthesia; from 1926 to 1928, ether, mainly by the rectal route; 1929, local novocain-adrenalin anæsthesia with morphia; in 1929 and 1930 we returned to rectal ether; 1931, local novocain with morphia again; 1932, avertin with ether vapour; routine cocainization of throat added; 1932 and 1933 avertin-morphia. Naturally we made occasional trials of other methods, such as intravenous nembutal, gas-and-oxygen, with various adjuvants, etc., but these methods were so much less satisfactory that they were never extensively employed.

To begin with we depended entirely on ether, administered as vapour by a nasal or tracheal tube, to produce full surgical anæsthesia.

The few cases operated on under local anæsthesia soon taught us the local hæmostatic advantage of novocain-adrenalin infiltration and we began to use it routinely along with ether. This was a real advance both for hæmostasis and because a much lighter general anæsthesia could be used.

I must say that with inhalation ether we were not troubled by chest complications or by much post-anæsthetic vomiting, but ether anæsthesia often had to be carried to a depth otherwise unnecessary in order to abolish laryngeal irritation by the vapour.

This led us to give the ether per rectum, and after a short time a preliminary rectal injection of paraldehyde was added to our practice. This produced a primary drowsiness and an amnesia greatly facilitating induction, and it also gave some hours of drowsiness after operation with a quiet awakening. The rectal ether gave a smooth light anæsthesia without laryngeal irritation.

We became increasingly impressed with the slack, easily mobilized brain and the absence of congestion in cases in which we tried local anæsthesia. We began to realize that ether, increasing the secretion of cerebrospinal fluid and often increasing the blood-pressure, was inimical to satisfactory conditions for cerebral operations, more especially when there was already increased intracranial pressure, and when exposure of the lesion required cerebral retraction, as in cerebello-pontile-angle or pituitary cases. A determined effort was made to employ local anæsthesia as the routine method. It was preceded by a suitable dose of morphia in the form of omnopon; ¾% novocain in normal saline to which 1% of the 1:1000 adrenalin

solution was added was infiltrated. Many other alternatives to morphia were tried, as we realized the inconvenience of the occasional vomiting, during or after operation, which is inseparable from the use of any morphia preparation. None other was satisfactory. Sleep might be induced, but the first touch of the novocain needle would rouse the sleeper to uncoöperative restlessness, and only morphia was sufficiently analgesic and comforting to give satisfactory results with local anæsthesia. The safe dose of morphia or any similar drug is of course far short of rendering the patient unconscious. In the cases that "go well" local anæsthesia is indeed ideal but two things are necessary to complete success. Firstly, a patient of exceptionally coöperative disposition and of great fortitude and endurance; and secondly, a patient who responds well to morphia. The former are distinctly rare in Scotland, and there are a sufficient number who are not well affected by morphia to constitute a troublesome minority.

After a six months' trial of local anæsthesia with many cases, which left little to be desired in improvement of anæsthesia but with still too many unpleasant experiences, we reverted to rectal ether, substituting luminal for paraldehyde in preliminary medication. Luminal was an improvement, for paraldehyde occasionally caused excessive bronchial secretion and sometimes too profound a somnolence for twelve or more hours after operation. Still, the disadvantages of ether were patent enough, and finally, after vacillating between local anæsthesia and rectal ether, we tried avertin.

Avertin has the advantage of inducing a quiet sleep with no discomfort, and of ensuring a sleep for from three to six hours after operation with a peaceful awakening. It cannot be safely used as the sole anæsthetic agent; its dosage must be restricted to about 0·1 grm. per kilo, which causes deep sleep but not surgical anæsthesia, for its effect is not primarily analgesic. In this dosage, with slight variation for individual cases, it can now be regarded as quite safe. It has the extraordinarily valuable quality of causing a significant fall in blood-pressure and in intracranial pressure without impairing the effective circulation of the recumbent subject. At first we made the error of supplementing avertin with ether. This quite undid its benefit in reducing blood-pressure and relaxing the brain.

Finally, realizing this defect and following the published work of Dr. Dorothy Wood [1], San Francisco, we are now using as our routine method avertin and morphia in the form of omnopon. The avertin causes a profound sleep and the morphia is sufficiently analgesic, so that the patient is not wakened by novocain infiltration or operation noises or movements. Hyoscine may be added and repeated during a long operation if restlessness supervenes after some hours.

We often cocainized the throat for intratracheal intubation, and now do so routinely to facilitate the use of airway or tracheal tube, should occasion arise, in a patient under light anæsthesia.

Other things being equal, it is highly desirable that the patient should be totally unconscious of the operative procedure, and be perfectly still and quiet. Local anæsthesia, however supplemented, does not realize these conditions. It is desirable that there should be as little tension and œdema of the brain as possible and that the blood-pressure should be somewhat below normal for the individual. Ether acts in direct opposition to these particular requirements of cerebral surgery.

Avertin-morphia anæsthesia with local infiltration comes nearest to the ideal. Induction is as quiet and easy as natural sleep. The operating conditions with low blood-pressure and relaxed brain and unconscious patient are ideal. Awakening is desirably delayed and quiet. There remains the one disadvantage—occasional post-operative vomiting from the use of morphia, though this is minimal when omnopon is used. If we could discover a reliable analgesic and sedative which did not cause vomiting, to replace the morphia group, I should feel satisfied with anæsthesia for cerebral surgery.

There are two classes of cases to which we have not yet extended the avertin-morphia method. Trigeminal neuralgia cases are operated on in semi-sitting posture and with head erect; most of the patients are elderly, and many have some degree of arteriosclerosis. In these conditions we have feared the consequences of the artificial fall in blood-pressure caused by avertin, and meantime we continue to use rectal ether in these cases. Again, in many operations on the spinal cord, somewhat alarming falls in blood-pressure are incidental to manipulations of the cord, and we shall continue to use rectal ether or local anæsthesia in these cases also.

Reference.—[1] WOOD, DOROTHY A., "Further Reports on the Use of Tribromethanol (Avertin)," *Anæsthesia and Analgesia*, 1933, xii, 38-42.

Dr. Z. Mennell: Most of my work in this connection during the past thirty years has been done with the late Sir Percy Sargent, who had actually promised to take part in the present discussion.

The slow technique adopted by some surgeons in recent years has altered the anæsthetist's outlook and methods.

I represent work done in conjunction with the more rapid type of surgery, and it is, perhaps, difficult to accommodate my ideas and practice to the slower type. It is impossible to combine the two methods satisfactorily, either from the anæsthetist's or the patient's point of view. Anything taking over an hour or, at the outside, an hour and a half, is what I call slow, and requires a different type of anæsthesia.

Chloroform was perfectly safe and satisfactory for Horsley, who never took over half an hour. Ether was best for Sargent, who never took over an hour and a half. But neither of these anæsthetics is satisfactory for the lengthy operations of from two to six hours, which are becoming commonplace.

Ether given by the plenum method, either intratracheal or intrapharyngeal, is my anæsthetic of choice for the quick operations. I recommend the use of atropine in large doses, and the avoidance of morphine.

In 1912-1914 I used intravenous hedonal for over two hundred head cases. My experience of this barbiturate did not make me give up ether, and when the intratracheal method was introduced into this country I discontinued hedonal entirely. The more modern nembutal and pernocton have not altered my opinion of the use of the barbiturates in head work.

For certain cases in which there is no intracranial pressure avertin is very useful, especially when used in conjunction with local analgesia. This seems the anæsthetic of selection for gasserectomies. When pressure is present to any high degree it is difficult to estimate the dose necessary, and it is impossible to lessen the dose when the pressure has been relieved by opening the dura, a very important point. Again, I like it for operation on the pituitary gland, but Sargent disliked it as he considered that the patients were inclined to bleed after returning to bed. In fact, he had two deaths from this cause; a similar result had not occurred after the use of ether.

For operations lasting longer than one and a half hours the choice must lie between continuous nitrous oxide, preferably by the intratracheal method, or local analgesia—both necessitating previous medication. I think it does no harm giving some ether in the earlier stages of continuous gas-oxygen, and it is astonishing with modern machinery how quiet it is possible to keep the patients, and, of course, the nitrous oxide has practically no effect on their condition.

In considering these cases it is impossible to dissociate entirely from the anæsthetist's mind the method of surgical procedure employed. Speaking as one who has seen all methods, I cannot see the object of being slow in removing a bone flap. It is comparable with every other surgical operation; there is nothing peculiar about it. Hæmorrhage *can* be prevented and the flap removed in a short

time. When the dura has been exposed it is reasonable to suppose that some advantage may be gained by deliberate methods and the use of the thermo-cautery (diathermy). I have certainly seen the most disastrous shock occur by the rapid removal of big tumours and a very serious fall in blood-pressure. If there is any method of obviating such a degree of shock it should be employed.

The greatest change has been brought about by the use, in cases of really high intracranial pressure, of high percentage saline and glucose intravenous injections to reduce it.

The cases which are still a problem to me are those dreadful cases of extreme pressure, when it is almost impossible to induce anæsthesia on account of the shallow respiration. In such a case I use chloroform in high concentration, and directly there is relaxation, pass a catheter and use ether.

Dr. J. F. Ryan: My experience of anæsthetics in cranial surgery has been confined almost entirely to the more rapid type of operation. I have given anæsthetics in more than 400 of these cases, most of them at the National Hospital, Queen Square. In about 350 of them endotracheal ether was used.

The type of anæsthesia is essentially a very light one; this is made possible by the perfect airway afforded by the intratracheal catheter whatever the position of the patient, and by the constant strength of ether vapor which can be delivered quietly and under low pressure by means of a motor pump. If the catheter is securely fixed so that it remains perfectly still between the vocal cords, it is surprising how very light an anæsthesia it is possible to maintain without the assistance of any pre-medication, except, of course, the usual dose of atropine. Any movement of the catheter will produce coughing, which is not permissible in these cases; it can be stitched in position to the angle of the mouth, or is quite easily held there by means of a towel clip. The use of the intratracheal method has the obvious advantage of providing for the immediate delivery, if required, of oxygen or of carbon dioxide and oxygen. If by any chance the anæsthesia becomes too light, it is quite a simple matter to increase the concentration of the ether vapour in the presence of a little carbon dioxide without causing the patient to cough. Apart from passing interference with the rhythm of respiration, due to manipulation in the region of the medulla or to alteration of intracranial tension on opening the dura, only one of my cases caused anxiety from the point of view of respiratory failure.

This, which ended fatally, was one of a high laminectomy performed on a girl, aged 14, who proved to have malignant disease of the spine. She had had some difficulty with her breathing beforehand, owing to the position of the growth, and this was increased by the operation being performed in the prone position with a sandbag under the sternum. The induction of anæsthesia had been uneventful, but directly she was turned over on her face her breathing became difficult and she was very cyanosed. She died from respiratory failure after thirty minutes, having had no anæsthetic from the time the operation was begun. This death was, I think, due to the combined effect of the lesion from which she was suffering and of the position in which she was placed.

The chief criticisms which have been offered to ether anæsthesia in cranial surgery are that it causes: (1) Swelling and increased vascularity of the brain due to congestion following induction and to the direct irritant effect of ether. (2) Increase of shock from the amount of ether used. (3) Vomiting, with the possible risk of producing bleeding in a previously dry operative field. (4) Post-anæsthetic chest complications. The swelling and congestion of the brain I can well understand if the anæsthesia is an uneven one, given in the presence of an imperfect airway, possibly after a bad induction.

The amount of ether used in these shorter operations is not sufficient to add to shock which may be present. The factor which primarily determines the

patient's condition is hæmorrhage. What would be looked upon as a comparatively small degree of hæmorrhage in other operative fields has a profound effect on blood-pressure and pulse-rate in these cases. I do not think that the vascularity is sufficiently increased under light ether anæsthesia to add appreciably to the difficulty of controlling hæmorrhage, either extra- or intradural. I have not seen the extreme swelling of the brain which has been described as being due to ether, nor have I heard of post-operative hæmorrhage being attributed to vomiting. There is no reason to believe that chest complications are more frequent after head surgery than after surgery of other parts of the body.

Avertin is best avoided in operations in which there is likely to be much interference in the region of the medulla, should be given with extreme care in cases with high intracranial pressure, and should definitely be avoided altogether where the patient shows any signs of drowsiness or incipient coma, or has shown any such signs during the period before operation.

The personal comfort of the patient is of little importance in head cases, for the majority of these patients worry very little about the anæsthetic or the operation, a considerable number of them being in too confused a state to worry much about anything, and the others glad to have something done for them. Avertin must be used with some form of anæsthesia, general or local; the former is preferable. Very small quantities only of ether are necessary, and a quiet, stable anæsthesia results. The use of avertin and novocain is apt to result in much restlessness, especially if the operation is so long that the effects of the novocain begin to wear off. The restlessness is accompanied by rapid and considerable variations of blood-pressure, and altogether the state of affairs has most of the disadvantages of a badly given general anæsthetic. Novocain, however, seems to have an excellent hæmostatic action on the tissues of the scalp. Simple local anæsthesia works admirably in the minor operation for ventriculography. The fall of blood-pressure following the administration of avertin is temporary only, and is of the same degree and type as in other operations, usually recovering to normal in about fifteen minutes. If the patient's condition warrants its administration, I think it can be given with safety and success in combination with intratracheal ether or gas-oxygen-ether, the latter in those cases in which there is likely to be prolonged use of the electrical methods of dealing with the brain. The ether supply can be cut off while there is any risk of explosion, and the anæsthetic continued with gas-and-oxygen. If gas-and-oxygen is used, it should be given by the intratracheal route, and have sufficient ether mixed with it to ensure the provision of a high percentage of oxygen.

Dr. J. H. T. Challis: The following is a rough outline of the method of anæsthesia employed by my colleagues and myself in connection with brain and spinal cord surgery during the last five years, in which time 346 operations have been performed by Mr. Hugh Cairns.

Induction is made with nitrous oxide, oxygen, and ether, only sufficient ether being given to ensure the passage of a nasal tube into the trachea. The judicious use of carbon dioxide greatly facilitates this intubation and diminishes the amount of ether required.

I do not, personally, approve of the practice of cocainizing the throat unless abnormal difficulty is anticipated with regard to the passage of the tube.

The intratracheal tube, having been introduced, is attached to a Magill bag and outlet valve connected with any gas-oxygen-ether apparatus available—Boyle's, with dry flow meter, being that of choice.

Once the patient is arranged for operation, it is only with the utmost difficulty that one can get a look at his face, as the eyes are covered with gutta-percha, and the whole head and face—with the exception of the nose and mouth—are draped in sterile towels. One hand and arm are left exposed to enable the anæsthetist to

obtain his various data throughout the operation. As early as possible he proceeds to record blood-pressure and pulse and respiration rates, and he continues to chart his readings every five minutes during the operation. Depth of anæsthesia is judged entirely by the movements of the Magill bag and by the colour of the exposed hand and of the site of the operation.

After the operation is concluded, if there has been no undue loss of blood or shock during its performance, the patient should cough on removal of the intratracheal tube, and respond to requests to open his eyes, or to put out his tongue, within five minutes of the discontinuance of the anæsthetic.

Mr. Cecil P. G. Wakeley said that he used local anæsthesia, combined with either intratracheal gas-and-oxygen or avertin for all his neurological operations.

Section of Odontology.

President—A. E. Rowlett, L.D.S.E.

[*January* 23, 1933.]

Von Recklinghausen's Disease with Local Tumour of the Palate.

By George T. Hankey, L.R.C.P., M.R.C.S., L.D.S.

The patient, Mrs. T——, aged 44, presented herself at my out-patients department at the London Hospital, because her remaining eleven teeth worried her. This was her only reason for attendance this time, although she had had an operation on a femoral hernia only three months earlier. Nobody at that time noticed a soft tumour of the hard palate, the size of a walnut, and this failure to notice it shows how benign the tumour was and how completely accustomed to its presence the patient had become.

History.—The only history of the growth was that it had been present ten years before, when the upper molar teeth on that side were extracted, the patient's attention having been called to it by the dental surgeon. It had never given her any pain or inconvenience, in spite of its size, but it sometimes seemed to become a little larger and then to subside; this was no doubt owing to œdema. She had no memory of its early history.

On examination.—The remaining teeth were septic. There was a soft, fleshy tumour the size of a walnut, and flattened from pressure of the tongue, covering most of the right half of the hard palate. Its colour was the normal pink of the buccal mucous membrane. It looked slightly œdematous, but there was no sign of inflammation, and it was neither tender nor painful. It was not pedunculated; the base was almost as large as the lingual surface. There was no enlargement of retro-pharyngeal or cervical glands. It was a soft innocent tumour of the sub-epithelial layer of the hard palate. The mucous membrane was stretched evenly and smoothly over the tumour.

At this visit she volunteered no further information, and as all visible portions of her anatomy—face, neck and hands—appeared normal, and gave no clue to the correct diagnosis, I diagnosed the tumour as a fibro-papilloma of the palate and subsequently removed it under local anæsthesia a few weeks after the teeth had been extracted. The removal of the growth was essential in order to fit full dentures. Unfortunately the tumour was not photographed *in situ*, not being considered a rare specimen at the time.

Operation.—I made an incision all round the base of the growth, and then dissected it from the palate. It was at once obvious that the tumour was something unusual; it was almost gelatinous, without a definite capsule, and extremely vascular. Several bleeding points had to be ligatured. Subsequently the wound healed by clean granulation, and now, one year later, it is impossible to see whence it was excised.

At the end of the operation the lower part of the right forearm became exposed, and I noticed one small sub-epithelial tumour, which aroused my suspicions; and on

rolling up the patient's sleeves and partially baring her chest, I had no doubt as to the diagnosis of von Recklinghausen's disease, or molluscum fibrosum. It remained to be seen whether the tumour just removed was of the same nature, and Dr. Wood's pathological report bore out this conclusion :—

"The tumour is a fibrous nodule projecting under the epithelium of the palate, and is probably a neurinoma. There are several nerves embedded in the base of the tumour."

The microscopical sections, stained with hæmatoxylin and eosin and with van Gieson's stain, showed the typical appearance of a neurofibroma (fig. 1).

The patient was seen by Dr. W. J. O'Donovan, who agreed with the diagnosis of her general skin condition as von Recklinghausen's disease (fig. 2).

Pathology.—Von Recklinghausen's disease is generally familial—the patient's father, her paternal aunt and her own sister, were all covered with similar tumours.

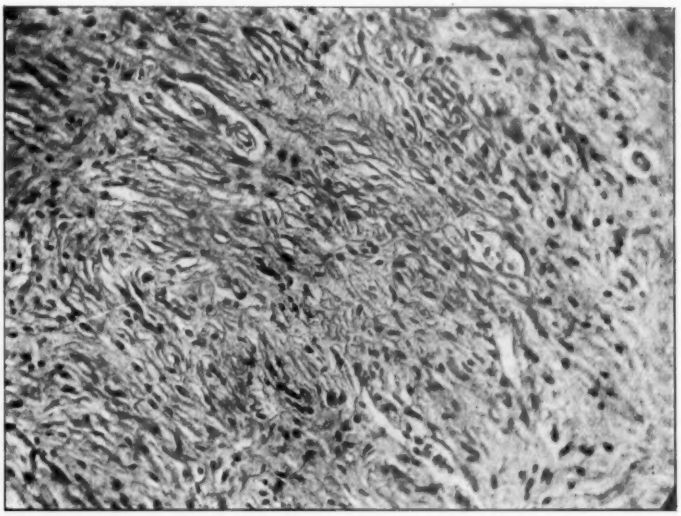


FIG. 1.—Section of tumour of palate: von Recklinghausen's disease. × 250.

A true neuroma is rare, and usually arises from the sympathetic fibres or ganglia. Neurofibromata are common ; they consist almost entirely of fibrous tissue from the nerve sheaths and from the endoneurium—the connective tissue immediately around the fibres. In microscopical sections it is often very difficult to demonstrate any nerve tissue ; a few nerve fibres may be seen at the periphery.

In the condition of molluscum fibrosum there are innumerable tumours in the distribution of the sensory nerves and related to the skin terminations. In addition there may be changes of the surrounding tissues, such as small pigmented patches. The tumours may be sessile, or pedunculated, or subcutaneous with a normal skin covering. They are fibrous, or myxomatous from degeneration of the fibrous tissue. Innumerable tumours may cover the body ; they are unsightly and inconvenient, but are seldom painful unless irritated. The patient otherwise suffers no ill-effects, and there seems to be no predisposition to cancerous changes. In the condition of

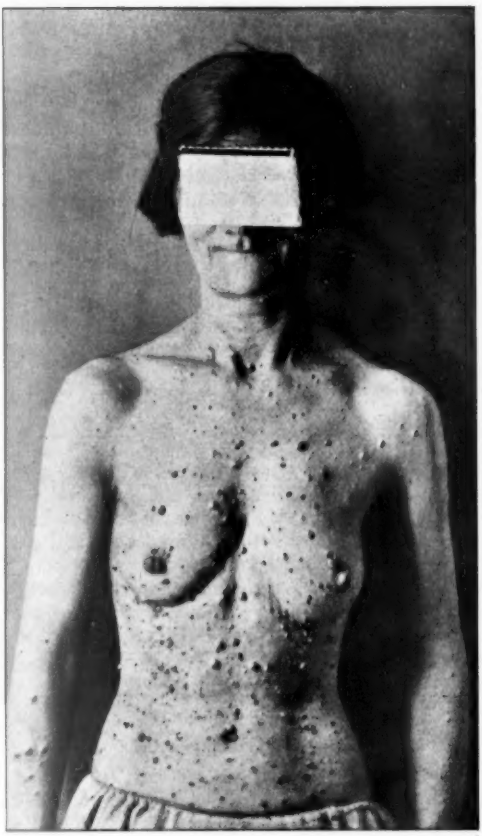


FIG. 2.

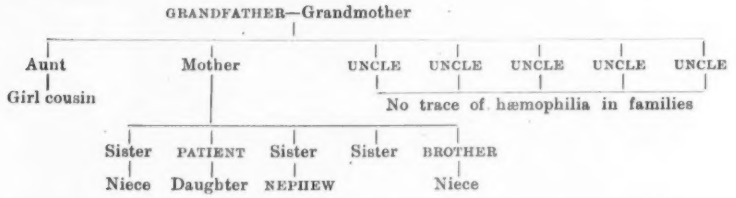
neurofibromatosis, another variety of von Recklinghausen's disease, the tumours are confined rather to the sensory nerve trunks, and can be felt as lumps along the distribution of the nerves. They may cause pain, as sensory nerve changes, but they do not involve the skin. Surgical interference is risky, owing to the danger of sarcomatous changes.

Dr. F. PARKES WEBER said that, so far as he knew, the palate was a very rare site for a neurofibroma, and he was much interested to have seen this case. He thought that it was more usual to meet with a case of von Recklinghausen's neurofibromatosis without, than with, any family history of the disease—that was to say, he thought that isolated cases of the disease greatly exceeded the number of family groups, but not the total number of familial cases, if each affected member of a family group were counted as a separate case. He believed that the two main types of von Recklinghausen's disease mentioned by Mr. Hankey —the neurofibromatosis of nerve trunks and cutaneous neurofibromatosis (molluscous fibromata)—were not rarely associated in the same patient.

Some Observations on the Extraction of Teeth in Cases of Hæmophilia.

By J. Draper Cambrook, L.R.C.P., M.R.C.S., L.D.S.

Hæmophilia may be defined as "an inherited abnormality of the blood, limited to males, but transmitted through females, characterized by tendency to excessive hæmorrhages and prolonged clotting-time." Each generation consists of male bleeders who do not transmit the defect and of females, apparently unaffected, who do transmit.



This is the genealogical tree of a private patient who was sent to me a few years ago. His grandfather was a hæmophiliac, but not very bad. His uncles were all hæmophiliacs, but there is no trace of the disease in their families. His brother died of multiple hæmorrhages a short while before I met the patient. His nephew is a bad case, and spends his life, metaphorically speaking, wrapped in cotton-wool.

Pathology.—There is a general consensus of opinion that the main factor in the production of the disease is a diminished coagulability of the blood. An undue friability of the capillaries is regarded as an additional factor by some writers. The increase in clotting-time is brought about by the slow liberation of prothrombin from abnormally resistant platelets.

Formation of Blood-clot.

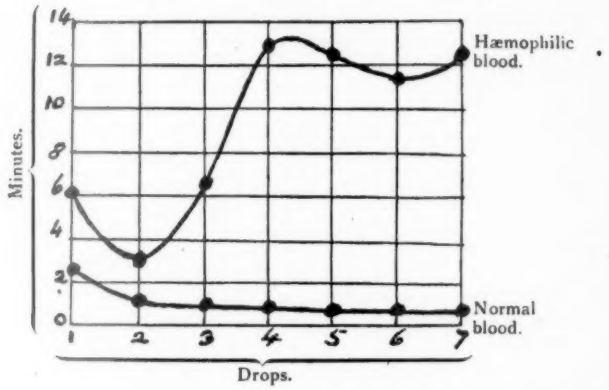
Prothrombin—Thrombokinase—Calcium salts
Thrombin : Fibrinogen
Fibrin : Corpuscles
Clot

The undue friability of the capillaries is given as the reason why there is a tendency to bleed. Gulland and Goodall [1] cite the case of a young hæmophiliac, who was always covered with bruises after a dance. The bleeding-time and platelet-count are usually about normal. Prolonged bleeding times are probably due to puncture of larger vessels, where a clot is necessary to supplement the contraction of the capillary wall and the agglutination of platelets sealing the wall. The estimation of the coagulation time is of great importance, but it is useless unless certain precautions are taken. At certain times there appear to be negative phases of the disease. Sahli discovered that during, or soon after, a hæmorrhage the coagulation time may be within normal limits. A period of remission may have the same effect. Two determinations should be made, when there has been no recent hæmorrhage, so as to obtain a conclusive result. Gibbs [2], and later Christie [3], found that the coagulation time decreased for each successive drop of blood, obtained from a needle-prick, up to the fifth or sixth drop, and Christie published curves to show this in various conditions. The chart on page 27 shows typical curves of hæmophiliac and normal blood [4]. The difference is very striking and

of diagnostic importance, and if it is not borne in mind, a high degree of error may be achieved.

An accurate method of estimating the coagulation time is by Gibbs' coagulometer.

Gibbs' coagulometer consists of a loop of platinum wire in a holder and protected by a guard. On the handle is a cork which fits into a glass tube. The procedure is as follows: A basin of water maintained at 37° C. is arranged in a good light. The glass tube is washed out in the water and placed in a convenient position. The patient's finger is pricked, a single drop of blood obtained, and a stop-watch started by an assistant. The loop is plunged into the blood and withdrawn so as to leave a bead on the wire. The instrument is pushed into its tube and then plunged into the water. The bead runs up and down the wire when the instrument is rotated backwards and forwards. Rotation is continued until the bead stops moving and then the watch is stopped. The time shown by the watch is the coagulation time.



A control reading should be carried out with normal blood. The bleeding time is estimated by applying a sheet of absorbent paper to a fresh small puncture every half minute. When the paper is no longer stained, the interval from the time of puncture may be calculated as the bleeding time. A control reading should also be taken in this case.

The modern treatment of hæmophilia aims at the control of hæmorrhage by the introduction of coagulative elements. These have been investigated by Christie and Gullan, of Edinburgh [6], and Payne and Steen, of Great Ormond Street [7]. I have summarized their results in the following table:—

Summary of Results of Coagulative Elements.

	Agent	Introduction	Effect on coagulation time	
			Immediate	Two hours later
1	Whole blood	Transfusion	Fall to normal	Fall to normal
2	Citrate blood	—	—	—
3	Citrated human plasma	Intravenous injection	Fall	Fall
4	Defibrinated blood	—	—	—
5	Human serum	Subcutaneous injection	Slight fall	Slight fall
6	Horse serum	—	—	—
7	"Hæmoplastin"	—	None	None
8	"Coagulin-Ciba"	Intramuscular injection	—	—
9	"Fibrogen-Merrel"	—	—	—
10	Calcium chloride	Intravenous injection	Slight rise	Slight fall
11	Sodium citrate	—	None	None
12	Protein shock	Subcutaneous injection	Slight fall	—
13	Liver	Mouth	None	None

The transfusion of whole or citrated blood caused the coagulation time to fall to normal but the original coagulation time was reached in five or six days. Transfusion for hæmophiliacs is not a simple matter as there appears to be a risk of agglutination when foreign blood is introduced. The blood must not only be of the same group, but should be tested directly for compatibility. Citrated human plasma was found to be not quite so good as 1 or 2, and defibrinated blood not so good as 3. The subcutaneous injection of human and horse-serum caused a slight transient fall in the coagulation time. The subcutaneous injection of "hæmoplastin" and the intramuscular injection of "coagulin-Ciba" and "fibrogen Merrel" caused no immediate or remote improvement. Calcium chloride, given intravenously, produced a slight rise in the coagulation time, followed by a slight fall. Sodium citrate, given intravenously, produced no effect on the coagulation time but it did produce a very marked improvement in the symptoms of those patients who received it. Protein shock produced a slight decrease, but it was very transient. Prolonged administration of liver by mouth had no effect. Dr. Pickering, of King's College [8], has carried out important work on the treatment of hæmophilia by the addition of liver to the diet. He found that the daily ingestion of liver caused a very marked decrease in the coagulation time and also produced freedom from symptoms. In two cases, boys were allowed to play boisterous games after treatment and there was no return of symptoms. He also tested the effect of "protagulin" and found that when added to hæmophiliac blood, the coagulation time became normal. Bleeding from small cuts was completely arrested in less than two minutes. The effect of liver therapy was subsequently tried at St. Bartholomew's Hospital, but no positive results were obtained. In America, the effect of giving ovarian extract was tried. The argument was that as hæmophilia is only exhibited in males, anything which will tend to repress male characteristics will also repress hæmophilia. Carrol Birch, of Chicago [9], gave one boy 15 grm. of extract daily by mouth for nine months. During that time, he was free from symptoms and had a normal coagulation time. Another boy had extract for a few days and then had a piece of fresh ovarian tissue grafted into his abdominal wall. This took five and a half months to absorb and for that time he had a normal coagulation time and was free from symptoms. I understand, however, that others have not been able to repeat these successes.

My present treatment of hæmophilia differs from any of the previous methods in that I give an intramuscular injection of whole blood. I use about 15 c.c. of blood from any donor, and inject it into the gluteal muscles. I have carried out this technique for only three months, but I have extracted teeth successfully for three patients with good results. The last case I had was in a boy aged 9, with a typical hæmophiliac history. His maternal grandfather always bled freely, his cousins bled copiously and easily, and his brother had bled to death a few years previously. He himself always bled very easily, and it was a great trouble to stop the bleeding. He had $\underline{|6}$ and $6|$ badly carious and giving rise to a great deal of pain. His coagulation time was prolonged and his bleeding time was within normal limits. I took 15 c.c. of blood from a donor into a sterile syringe and injected it into the muscles of the buttock. A general anæsthetic was then given and I extracted the two teeth, using great care to prevent any undue injury to the soft tissues. When the patient regained consciousness he washed out his mouth, the bleeding stopped, and there was no further hæmorrhage at all. The sockets healed normally and the boy returned home in the course of a few days.

I have searched the literature on the subject and I have found only one reference to intramuscular blood injection for hæmophilia. H. and A. Pereira [10] gave 25 c.c. to a hæmophiliac who had been suffering from hæmaturia, melæna and bleeding from the gums for eight days. He was almost moribund when it was given, but the bleeding was arrested in four hours, and there was no further trouble for nine months.

With regard to the local treatment, there must be some appliance to insert into the mouth and cover the sides and orifices of the sockets. This may provisionally be of composition or plaster, but a special vulcanite plate is much better. It certainly allows compression to take place, in conjunction with a four-tailed bandage. The appliance, by its pressure upon a plug, or the margins of the socket, does definitely keep the loss of blood within bounds and give it a greater chance of clotting.

With regard to the different kinds of hæmostatics used in plugging sockets, for hæmophiliacs I have found nothing better than cotton-wool soaked in fresh human blood and applied to the socket after removal of all clots. This causes clotting, but presents difficulty in removal. If it does not come away easily it should be left in position until it comes away of its own accord. For the persistent oozing which seems a constant feature of hæmophiliac sockets, I have had the best results from the injection of adrenalin. This is combined with normal saline in the proportion of adrenalin ♏ 5 to normal saline c.c. 2. This injection must be made with great care as it may upset the patient, and too much will cause a rise in blood-pressure and so defeat its own ends.

I will now describe a case which was sent to me a few years ago—that of the patient whose genealogical tree is shown on page 26. He had $\frac{4321 \mid 23\ 78}{7\ 4321 \mid 1234}$ present in his mouth. The missing teeth had not been extracted, but a rubber regulation band had been placed around each tooth at the gum margin. This set up periodontal trouble, and in course of time the teeth had fallen out. Painful, but effective!

The patient had very bad pyorrhœa, and there had been bleeding from the gums for seven weeks. This had been stopped by the application of cotton-wool soaked in adrenalin, only to break out in a fresh place. As it had been getting worse and was becoming more profuse, it was decided to extract the teeth. The blood test showed the coagulation time to be much prolonged, but the bleeding time was within normal limits. There was a slight degree of anæmia, and the presence of immature blood-cells showed that the bone was being slightly taxed to keep up with the loss of blood. There was a relative lymphocytosis, suggesting a moderate degree of toxæmia.

A transfusion of 200 c.c. of whole blood was given, and three teeth were taken out under local anæsthesia immediately afterwards. There was no bleeding and the following day three more teeth were extracted. There was a little hæmorrhage after this, but it was easily controlled. The mouth was cleared in about three weeks, there being intervals after each operation, so that the sockets could partially heal before the next extractions. There was considerable steady oozing at times and the hæmoglobin fell from 88% to 68%, and the red-cell count from 4,800,000 to 3,800,000. On more than one occasion I should have liked to have given the patient a small transfusion, but he objected so strongly that I continued to use local measures and reserved the transfusion for a greater emergency. I managed to control the hæmorrhage by means of pressure and the injection of adrenalin.

The patient was a big man with a large appetite, and he complained of the monotony of his "pap" diet. I am afraid that too frequently in nursing homes egg flip is considered to be the standard article of diet in these cases, whereas it should be merely a form of extra nourishment. I composed several menus for this patient, one of which is given below.

MENU.

6 a.m. Egg flip with sherry.
Breakfast. Porridge: two scrambled eggs; meat jelly; milk.
11 a.m. Egg flip with sherry.
Lunch. Broth: mince; baked custard.
3 p.m. Egg flip.
Tea. Two poached eggs, minced; tea.
Dinner. Soup: minced herrings; mince; rice pudding; milk.
11 p.m. Egg flip.

The patient returned home to his own dentist who fixed him up with full upper and lower dentures and he was very comfortable. I regret to say that he was operated upon about nine months later and died as the result of hæmorrhage. There was a vain search for a suitable donor for transfusion but one could not be found immediately and when he was transfused with a suitable blood, it was too late and he did not recover.

There are several points in treatment which I wish to emphasize. The patient should always sit up in bed and the bowels should always receive attention. Straining at stool can all too easily cause bleeding to recur or to increase. The breath becomes very foul as the result of continued hæmorrhage and the presence of clots in the mouth. I prefer hydrogen peroxide as a means of keeping the odour within bounds. Alcohol must be forbidden but a little sherry may be used in the food. As an aperitif, I have found that patients appreciate tonic water and bitters.

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Special Communication.

Alleged Loss of Calcium Salts from the Dentine of a Dog associated with Abnormality of the Parathyroids.

By E. W. FISH, M.D., L.D.S., D.Sc.

IN the *Proceedings*, 1932, xxv, 893 (Sect. Odont., 35), the present author reported the results of analyses of the dentine from two dogs which were found to be suffering from a disease in which all the bones had softened and become elastic and radiolucent as shown by skiagrams then published. This bone condition was associated in one of the dogs with fibrotic degeneration of the parathyroids. The parathyroids of the other animal were not available. The analyses were expressed as percentages and calculated on the *wet* weight of the dentine. As the report was a clinical observation, no direct controls were available and the results were compared with previously determined calcium percentages in normal dogs used as laboratory controls. Owing to the lapse of time between the two estimations, it was not realized by the analyst that the previous calculations were based on the *dry* weight, hence there was an apparent loss of calcium from the dentine in the dogs with soft bones. As this observation was unique, it was held up for two years by the author, and then, as it remained apparently valid, it was eventually published.

A few weeks after publication a further batch of controls for another experiment were analysed, and, fortunately, were again calculated on the wet weight. This naturally aroused the author's suspicions and on reference to the analyst the confusion became apparent. The author much regrets that the previous communication should have been misleading. When both calculations are based on the dry weight of the specimens, the result shows that the calcium content of the dentine in the dogs with soft bones was absolutely normal. Nevertheless, reference to the extreme decalcification of the bone in the skiagrams then published makes this

observation even more significant than the fallacious one, but in the opposite sense. The corrected figures are :—

	Percentage of CaO	Average percentage of CaO
Dog A Specimen (1)	35·37	
Specimen (2)	33·49	35·14
Dog B Specimen (1)	35·84	
Specimen (2)	35·87	
Average of eight specimens from normal dogs ...	35·35	

These figures are a striking indication of the extreme stability of the calcium content of the dentine, even when the bones are losing most of their inorganic content. The corrected result given above is much more in keeping with the results of various experimental attempts to alter the calcium content of dentine, which have always failed in the author's hands.[1]

[1] Fish, E. W., "An Experimental Investigation of the Enamel, Dentine and the Dental Pulp" (London), 1932.

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[*March* 3, 1933.]

DISCUSSION ON ACUTE AND CHRONIC INFLAMMATORY DISORDERS OF THE ETHMOIDAL AND SPHENOIDAL SINUSES.

Ætiology and Treatment of the Acute and Chronic Inflammatory Disorders of the Posterior Sinuses.

By FERNAND LEMAITRE and ANDRÉ AUBIN.

THE acute and chronic inflammatory disorders of the posterior sinuses appear in so many different aspects with differing ætiology and require such a variety of treatments that we have decided to put forward a classification of the numerous forms of posterior sinusitis.

We suggest the classification comprised in the following table :—

Acute forms.

Catarrhal	
Inflammatory	
Suppurative (simple)	
Suppurative, complicated by	Osteitis (localized or diffuse)
	Orbito-ocular lesions
	Intracranial lesions
	Vascular infections (septicæmia)

Chronic forms.

Non-suppurative	Sine materia
	Simple catarrhs
	Hyperplastic (Woakes' disease)
	Polypoid
Suppurative (simple)	Open
	Closed (closed empyema)
Complicated by	Osteitis (localized or diffuse)
	Orbito-ocular lesions
	Intracranial lesions
	Vascular infections (septicæmia)
	Focal infection

These anatomical forms are encountered clinically in a variety of aspects, and in addition two more clinical forms require mention—the latent and the recurrent. Further, in the ethmoid, lesions may be limited to one or two cells. These cases of partial ethmoiditis, brought to light by the method of puncture with aspiration of Watson-Williams, require emphasis because they have special characters. Still further there is the posterior sinusitis of childhood.

ÆTIOLOGY.

This may be divided into (1) the well-known facts which it is sufficient to recall, and (2) the debatable points which are far more interesting, and about which we propose to give you our personal views.

(A) *Well-known facts.*—(1) Ætiology of acute posterior sinusitis. This includes all the infections of the upper air passages : the coryza of adult life, adenoids in children, and especially the influenza of which we have seen the harmful results this year particularly. There are further fevers, especially measles and scarlet fever, and in addition diphtheria, erysipelas and pneumonia. We must mention also the part played by foreign bodies, including among these prolonged packing of the nasal fossa and nasopharynx, as well as gauze strips left by accident in the upper air passages.

(2) An acute infection may become chronic. There are numerous causes which aid this development: swelling of the ethmoidal mucous membrane; an unfavourable situation or narrowing of the ostium of the sphenoidal sinus; high deviation of the septum; chronic purulent infection of adenoids; clumsy nasal douching in cases of ozœna.

(3) The relationship between sphenoidal and ethmoidal sinusitis. This relationship is well known: there is the ease with which pus tracks from the ethmoid towards the sphenoidal sinus, and on the contrary, from there towards the ethmoid. It is arguable which sinus most frequently contaminates its neighbour. According to Grünwald the sphenoid leads in 73% of cases to an infection of the posterior ethmoid, while the latter is only complicated in 40% of cases by an infection of the sphenoid. According to Segura, however, sphenoidal sinusitis is almost always secondary to posterior ethmoiditis or to a pansinusitis.

(4) The micro-organisms. These are the ordinary organisms of suppuration, associated sometimes with staphylococci which predominate in chronic suppurations.

(5) The age of the patient. This is most frequently between 18 and 40.

(B) *Debatable points.*—The ætiology of acute and chronic purulent sinusitis may be simple enough, but the ætiology of non-purulent sinusitis—especially of polypoid sinusitis and hyperplastic sinusitis (Woakes' disease)—is not simple.

The discussion really begins here. It is not an affair of yesterday, since in the last century a quarrel raged between Woakes and Grünwald. Woakes, struck by the bilateral character of the lesions, and by the invasion of bone, considered it a disease of the entire ethmoidal labyrinth, drew attention to the lesions of bone, and described his "necrosing ethmoiditis." Grünwald along with the German school contested the genuineness of the bony necrosis and would only admit lesions of the mucous covering. He applied the word "mystery" to the ætiology of this disease, chronic from the start, progressive, generally bilateral and often familial.

Then again Bosworth, with the American School, dismembered "ethmoidal disease" into a number of sub-divisions, which J. MacKenzie, supported by Garel, opposed energetically. These two authors considered purulent sinusitis and polypoid sinusitis as two different stages in the evolution of the same disease.

In 1927 Jacques of Nancy took up the question. According to him it is the soil prepared by an inherited disorder of nutrition which plays the principal part. He observed in 70% of his cases hereditary syphilis and in 20% a preceding tuberculous infection.

We venture now to bring forward our own personal opinion. We also believe that the general condition of the patient, in fact the soil, plays an important part in the appearance and evolution of polypoid sinusitis, especially bilateral ethmoiditis (Woakes' Disease). Before leaving the question of ætiology it is necessary to say something about pathological histology because this illuminates the ætiology.

Histology teaches us that the reaction of the mucous membrane of the nasal fossa and sinuses to inflammation or irritation has a special character: it is an inflammatory pseudo-neoplastic reaction. The common polypus is the prototype: it is neither a myxoma (as it has been sometimes wrongly called) nor an œdematous fibroma: it represents a simple inflammation but of an œdematous neoplastic type. The polypi within the sinuses which are removed during a radical cure have the same histological character. The mucous membrane of the upper respiratory passages reacts in the same way to a suppurative inflammation (polypi in the sinuses) or to a catarrhal inflammation, or even to an ordinary irritant (simple nasal polypus).

If the process, either inflammatory or simply irritative, is prolonged, the mucous membrane, which at first only reacts superficially in the epithelial layer, begins to react in the deeper layer, especially in the periosteum, which in the ethmoid particularly is inseparable from the nasal mucous membrane. The participation of

the periosteum in the inflammatory process explains the lesions in the bone, the partial absorption of the bony layers, which secondarily take on the appearance of "necrosing ethmoiditis." This histological observation demonstrates how polypoid sinusitis and hyperplastic sinusitis (Woakes' disease) are histologically an identical inflammatory process in different stages.

Let us now apply these facts clinically and see what happens in paroxysmal rhinitis.

The discharge from the rhinorrhœa acts as a local irritant, which produces crusts or a fissure at the anterior nares, but in the ethmoid where the mucous membrane is particularly loose it produces an œdematous inflammatory reaction, the beginning of polypus formation. If the process continues, a bilateral polypoid ethmoiditis results, without pus in the ethmoidal cells at any time. At a more advanced stage the periosteum and then the bone are affected. The bilateral polypoid ethmoiditis becomes hyperplastic, and Woakes' disease is established.

We do not claim that every polypoid or hyperplastic ethmoiditis is related to paroxysmal rhinitis. Other processes, non-suppurative inflammation or simple irritation, can produce the same result by a similar mechanism.

We desire, however, to emphasize the part played by the general condition—by the "soil"—which, if our views are correct, is indirectly the origin of this bilateral non-suppurative ethmoiditis.

The neuro-arthritic or sympathicotonic soil, on which paroxysmal rhinitis develops, is perhaps itself dependent on the action of the endocrine glands in consequence of a disorder, doubtless hereditary, such as inherited syphilis or even tuberculosis.

Thus in our view the part played by the soil, as described by Jacques, is established, but indirectly in a peculiar and special way. We believe this view to be of importance in relation to treatment.

Treatment.

(I) Study of the methods available for the treatment of posterior sinusitis.
(II) Selection of the treatment appropriate to each manifestation of the disease.

(I) *Methods of Treatment.*—(1) *Medical.* (2) *Simple surgical.* (3) *Active surgical.*

(1) *Medical treatment.*—Inhalations and sprays.—Menthol in spirit is the customary form of inhalation, but if the nasal mucous membrane does not tolerate menthol, aromatic essences or balsam may be substituted.

Before each inhalation, the nasal fossa is sprayed with a solution of cocaine, ephedrine or adrenaline, containing a mild antiseptic, such as a salt of silver, to relieve congestion. The prolonged application of strips of gauze soaked in the solution is more effective. Some prefer the use of vaccines to chemical reagents, either autogenous or stock vaccines.

The administration of a small quantity of potassium iodide, 0·5 to 1·0 grm. daily (Hautant), is a useful addition. The iodide liquefies the nasal secretion and helps its expulsion.

General treatment.—In severe infections or complications vaccine therapy should not be neglected. We prefer propidon, which has given some excellent results.

Spa treatment.—Certain spas have a good effect. Mont Dore is indicated whenever a vasomotor element is present.

In the case of obvious purulent discharge, a sulphur cure should be recommended. The rule of Lermoyez, *le pus appelle le souffre*, still holds good.

(2) *Simple surgical treatment.*—We shall refer here to the methods of treatment which require special manipulations without any strictly surgical intervention; (i) Catheterization and lavage; (ii) puncture; (iii) suction; (iv) the displacement method of Proetz and Le Mée.

(i) Catheterization.—Catheterization is applicable only to the sphenoidal sinus. In most cases the ostium can be entered by a stiff catheter, which allows the sinus to be emptied. If catheterization is impossible the diaphragm of mucous membrane at the orifice can be broken through by the beak of the instrument (forcible catheterization). Simple lavage with saline solution or injection of antiseptics (silver salts, chloride of zinc) can easily be performed. This simple method, which is often effective, should be widely employed.

(ii) Puncture.—Puncture of the ethmoidal cells and the sphenoidal sinus has been employed by Watson-Williams, especially for diagnosis. It should be more widely used in the ordinary treatment of sphenoidal sinusitis.

(iii) Suction.—Aspiration, which is much employed in the United States, allows the removal of secretion concealed in inaccessible corners of the nasal fossa. The effect of suction is enhanced by shrinking the mucous membrane with cocaine.

(iv) The method of displacement of Proetz and Le Mée.—This method allows liquid to reach the spheno-ethmoidal cells merely by aspiration without perforation. The head should be tilted into different positions for each group of cells. This recently devised method, of which we have no personal experience, seems likely to become generally employed.

(3) *Active surgical treatment.*—(*A*) Treatment of the sinuses.—There are two routes for destroying the ethmoidal focus and opening the sphenoidal sinus: (i) the endonasal route, and (ii) the external or transorbital route.

(i) The endonasal route.—There are two procedures: The trans-ethmoidal endonasal route allows a combined spheno-ethmoidal operation; the endoseptal route of Hirsch and Segura is a purely sphenoidal operation.

The transethmoidal endonasal route (turbinal route).—This operation is always performed under local anæsthesia. It includes the following steps:—

(*a*) Dislocation or resection of the middle turbinal, if necessary.

(*b*) Complete exenteration of the anterior and posterior ethmoidal labyrinths.

(*c*) Opening of the sphenoidal sinus.

Operation by this route accomplishes the complete destruction of the ethmoidal and sphenoidal focus of infection at the cost of some consecutive crusting and anosmia.

The operation, although unfortunately somewhat mutilating, is satisfactory because it is complete and prevents any post-operative exacerbation. It has, however, the disadvantage of not allowing a complete exploration of the sphenoid, and a second operation is necessary if it is desired to open both sphenoidal sinuses.

However, in a strictly unilateral case, the healthy sphenoidal sinus is not opened, which is an advantage.

The endoseptal route of Hirsch and Segura.—This operation is performed under local anæsthesia and includes the following steps: (*a*) Resection of the septum as far back as the rostrum of the sphenoid; (*b*) exposure of the anterior aspect of the sphenoidal sinuses; (*c*) perforation with a gouge of the anterior wall of the sphenoidal sinuses; (*d*) drainage of the sinuses after breaking down the septum of mucous membrane.

This conservative operation leaves the nasal fossa intact, with its normal anatomy and structure. The two sinuses are opened at the same time and can be easily examined. This operation is perfect in bilateral sinusitis, but is not applicable to an associated ethmoiditis.

(ii) External transorbital route.—Advocated by those who prefer the *wide open door of the external route to the keyhole of the nasal orifice*, this procedure allows exploration of the orbit, complete exenteration of the ethmoid and opening of the sphenoidal sinus in full view and in absolute security.

It is easy to perform and has definite steps, but it does not give results much superior to the endonasal operation. It should not be employed unless there is a

complication threatening, or an orbital complication has already occurred. The only post-operative sequel to be feared is diplopia.

(*B*) Treatment other than of the sinuses.—It is indispensable to re-establish the nasal airway, nasal obstruction playing an important part in the production and maintenance of spheno-ethmoiditis. The correction of nasal malformations should be carried out during the course of one of the preceding operations, or even performed alone if there is no indication for an immediate operation on the sinus.

(II) *Selection of the treatment appropriate to each type of sinusitis.*

(*a*) *Acute types.*—Simple catarrhal form. Medical treatment is usually sufficient. Later to avoid recurrence all causes of nasal obstruction should be removed and spa treatment advised.

Inflammatory form.—The treatment is the same as that of the previous form, but vaccine therapy should be prescribed in addition.

Simple acute suppuration.—At first medical treatment is advised. If there is a tendency for the condition to become chronic, suction is indicated and then lavage after puncture or catheterization and perhaps the displacement method.

The acute form with complications.—Operation is required.

Two problems present themselves :—

(i) Which route should be selected? We think that the external route with full view is preferable to the endonasal route and is indicated particularly in the presence of orbital complications.

(ii) Is it necessary to perform a radical cure, or is it sufficient to establish free drainage? The objection has been raised to complete exenteration of the ethmoid and wide opening of the sphenoid that the infection may be spread and a localized osteitis transformed into a diffuse osteo-myelitis.

However, we believe at present that it is better to perform the radical operation right away in one stage. There is in addition the treatment of the complication to be taken into consideration.

(*b*) *Chronic types.*—(1) Non-suppurative type; simple catarrhal form: Medical treatment.

Hyperplastic form (necrosing ethmoiditis of Woakes): Complete exenteration of the ethmoid often bilateral by the endonasal route.

Œdematous and polypoid form: Complete exenteration of the ethmoid and opening of the sphenoidal sinus if the infection has extended so far, by the endonasal or turbinal route. This results in improvement, rather than in complete cure, because the cause persists. In addition, on account of the importance of the soil, especially if there is associated paroxysmal rhinitis, general medical and spa treatment is necessary. If there is a syphilitic basis, antisyphilitic treatment is necessary.

(2) Simple suppurative type.—Closed; closed empyema: Opening the infected cells with forceps by the endonasal route provides a wide communication with the nasal fossa and is usually sufficient.

Open: Medical treatment should be tried first and simple surgical treatment. If this fails active surgical treatment should be employed as follows :—

Ethmoiditis unilateral or bilateral: Total exenteration of the ethmoid, unilateral or bilateral, by the endonasal route. Sphenoidal sinusitis: Opening the sphenoidal sinus by the endoseptal route, especially if the sinusitis is bilateral.

Spheno-ethmoiditis: Exenteration of the ethmoid and opening of the sphenoidal sinus by the endonasal trans-ethmoidal route.

(3) Suppurative type with complications: Osteitis—orbital lesions; intracranial lesions; venous infectious septicæmia; focal infections: The indication for operation is the same as in the acute type with complications. The external transorbital route should be followed with complete exenteration of the ethmoid and a wide opening of the sphenoidal sinus. The complication needs attention also.

We are no longer at the stage when, a quarter of a century ago, Lermoyez said: "If we are well acquainted with anterior sinusitis, we do not know posterior sinusitis. We have not been introduced."

To-day the introduction has been made, thanks to catheterization, puncture, pharyngoscopy, aspiration, radiography, the method of displacement, and histology. Much is known already, even if it be only that the frequency of posterior sinusitis is recognized, but much remains to be done.

A. Lowndes Yates: The sinuses with which I propose to deal are the posterior ethmoidal and sphenoidal sinuses. There is considerable difference of opinion as to the pathological features of the discharge which justify the use of the term sinusitis. Some rhinologists include under this heading cases in which there is frank pus, others include those cases in which the sinus is filled with sterile mucus, and others those cases in which there is no increase of secretion, but micro-organisms can be cultured from the scanty contents of the sinus. Rhinologists are tending to take a wider view of inflammatory conditions in the nasal sinuses.

In the anterior sinusitis we can gain information from the condition of the mucous membrane in the region of the ostium of the sinus, and we have the aid of transillumination. In addition, radiography gives results which are more certain in anterior than in posterior sinusitis. The type of inflammation met with in the posterior sinuses differs little from that which affects the sinuses of the anterior group, but the diagnosis of the states of inflammation of these sinuses is more difficult because the mucous membrane on to which their contents are discharged is hidden from view and we rely on symptoms and on posterior rhinoscopy for diagnosis.

In any state of inflammation of a sinus, whether of the anterior or the posterior group, the final diagnosis must be made by the removal and examination of the contents of the sinus. In the posterior group of sinuses the results of inflammation may be far more serious than in the anterior group, for the following reasons:—

(1) The anatomical relations of the sinuses; the carotid artery, the optic nerve and the gasserian ganglion may come into close relationship with the outer wall of one of the posterior sinuses.

(2) Chronicity of the inflammation is liable to be established by reason of the lack of symptoms in cases of open sinusitis, and because the ostia of the sinuses discharge their contents on to an area of the mucous membrane which is neither in the inspiratory nor expiratory airway, and hence the sinus is not cleansed by sneezing.

(3) The peculiarities of the lymphatic drainage of the mucous membrane on to which the sinuses discharge their contents are of importance. The drainage is by two routes, one of which follows the ordinary path pursued by the lymphatics from the remainder of the nose to the cervical glands; the other is more important, in that the lymphatic drainage is, in part, accomplished along the lymphatic sheaths of the olfactory nerves by which infected products may pass to the meninges.

The complications met with as a result of the inflammation of these sinuses are due to the spread of inflammation (*a*) to the optic nerve, producing optic neuritis, (*b*) by the internal carotid artery—spread by this route is stated to be associated with insanity (Pickworth),—and (*c*) by the fifth nerve, which Barnes suggests as a possible route in encephalitis lethargica.

As in inflammatory states which affect the other sinuses there is, in some uncommon but important cases, a liability to spread of inflammation with complications as a result of treatment. This spread of inflammation seems to be found in those conditions in which the inflammation is maintained by the characters of micro-organisms rather than by the obstruction of the ostium of the sinus.

It is well recognized that there are many forms of inflammation of these sinuses in which treatment on accepted lines gives good results. There are a few forms of inflammation in which the accepted lines of treatment fail. The discovery of

lysozyme by Fleming opened new avenues of investigation of this matter, and I have examined the discharge from a number of cases of sinusitis by the following simple technique:—

I place a drop of the discharge beneath a cover slip upon the warm stage of a microscope. Lymphocytes are generally seen, and often some bacteria, in one variety of discharge. After a certain lapse of time the lymphocytes break down, the micro-organisms disappear and a transparent fluid devoid of microscopical characteristics remains. In other cases polymorphonuclear cells are present and the solution of the micro-organisms is effected with increased rapidity.

In another type of discharge the lymphocytes break down, but the micro-organisms remain and in certain cases, if inspected the following day, the mucus is seen to contain a greater number of micro-organisms than when first examined. It is clear that the mucus is acting as a culture medium for the micro-organisms multiplying in it. Cases which show the first type of discharge, the type which has a high lysozymic factor by which the micro-organisms are destroyed, prove to be cases in which the inflammation is maintained by the obstruction in the ostium of the sinus. Cases in which the lysozymic factor is low and in which the micro-organisms either are not dissolved or multiply within the mucus prove to be cases of open sinusitis in which the inflammation is maintained by the character of the micro-organisms.

The micro-organisms may be staphylococci, streptococci, Pfeiffer's bacilli or pneumococci, but the type of micro-organism is not of prime importance. The determining factor in the maintenance of inflammation is that the micro-organism has acquired the power of multiplying in the mucus.

The rough measurement of the lysozymic factor therefore gives us a method which may assist materially in determining which form of treatment will suit the case and in which cases operation is likely to be followed by complications. I found that if the lysozymic factor was high, simple methods of drainage gave the best results. Drainage alone is necessary to effect a cure, and drainage is best accomplished in acute cases either by nature or by shrinkage of the mucous membrane with cocaine. Watery douches diminish the lysozymic power of the mucus and in the laboratory it can be demonstrated that dilution of a bactericidal mucus converts it into an efficient culture medium. For this reason watery solutions must not be used for douching or for intra-sinus lavage in acute rhinitis. Operation also debases the lysozymic power and it is probably for this reason that the results of operation on acute states of inflammation are extremely bad.

When the lysozymic factor is low and micro-organisms multiply in the mucus, watery douches can be used, for there is no efficient lysozyme that will suffer from dilution. I can only refer briefly to the good results which follow diminution of the surface tension with sodium oleate or bile salts, especially when the douching fluid is caused to enter the sinuses by a modification of the displacement method of Proetz.

The treatment of closed sinusitis is to effect drainage either by causing opening of the ostium by palliative measures or by surgical drainage of a sinus. The treatment of open sinusitis is by palliative measures only, for drainage is already present and the inflammation is maintained by the ability of the micro-organisms to live in the mucus. It is therefore necessary that we should have more knowledge of the inflammatory state which we propose to relieve by treatment and it is probable that pathological investigation of the lysozyme can give us help in settling the form of treatment which will suit the case.

The estimation of the lysozyme seems to be of particular value in cases of posterior sinusitis, for in posterior sinusitis we cannot see the mucous membrane round the ostium and diagnosis is difficult.

Herbert Tilley: I will confine my remarks to chronic inflammation of the sphenoidal sinus. I am in entire agreement with Professor Lemaitre that chronic inflammation of this air-cell and of the posterior cells of the ethmoidal capsule is much more common than was formerly believed.

In so far as the sphenoidal sinus is concerned, there are at least three reasons why such a condition is frequently overlooked: (1) The relative inaccessibility of this air-cell when compared with that of the more anteriorly situated sinuses. Difficulties will be increased by high septal deviations. (2) The frequent co-existence of some pathological condition of the ethmoid capsule which alone might suffice to account for the symptoms. (3) Perhaps more important than either of these is the fact that in the frequent mild cases of chronic sphenoidal sinus inflammation, the subjective symptoms and objective manifestations are not seldom far removed from the lesion which is causing them.

Anterior rhinoscopy may reveal no obvious nasal lesion, but frequently the lateral wall of the pharynx will be seen to be covered by a peculiarly adhesive, greyish-brown secretion of mucus. Beneath this the lateral pharyngeal band is often swollen and hyperæmic.

Not seldom the laryngoscope will reveal that similar conditions are present in the larynx, particularly in the inter-arytenoid region, which may be swollen and covered with sticky mucus.

In such cases the nasal endoscope enables the surgeon to obtain a clear view of the posterior choanæ, and to detect the situation of pathological secretions, particularly of those which appear to issue from the superior and middle meatus. If a purulent discharge be seen in those regions, it may be possible with a long-bladed speculum, to press the middle turbinal outwards and see a pulsating drop of pus in the ostium of the sphenoidal sinus, and then to pass through it a suction cannula for the removal of pathological secretions from the air-cell.

One of the most characteristic signs of chronic suppurative inflammation of the posterior nasal sinuses is a purulent discharge with œdema of the mucous membrane in the anterior aspect of the olfactory sulcus.

If anterior and posterior rhinoscopy or nasal endoscopy fail to establish the diagnosis of chronic sphenoidal sinus inflammation, radiography or the displacement method of Proetz will often provide valuable information.

With retention of morbid secretions more typical symptoms will be present, such as occipital, vertical or supra-orbital headache, and sometimes a distressing pain referred to the mastoid region.

The underlying principle of treatment will be to provide for free, spontaneous, and permanent drainage of the sinus, and this can be secured only by removal of its entire anterior wall.

From the operative point of view it may be well to add two warnings: (1) Never curette away the granulations within the sinus; if they are very prominent it is better to wipe them out with dry gauze pellets; the smaller ones will disappear if free drainage has been provided. It will be safer to leave the outer wall entirely alone. (2) If too radical a removal of the lower part of the anterior wall be made, the spheno-palatine artery may be wounded, and cause troublesome hæmorrhage.

For a few days after removal of the anterior wall of the sinus, the opening appears to be blocked by an œdematous swelling resembling a polypus. This should not be interfered with because it invariably subsides spontaneously.

P. Watson-Williams: Retrobulbar neuritis is an affection which intimately concerns general medicine as well as our own specialty and it interests me especially, since it was the diagnostic problem which retrobulbar neuritis so often presents that originally suggested the method I have termed "suction-exploration" of the sinuses.

Retrobulbar neuritis occurs in affections in which rhinology plays no part, and when other differentiating signs are absent the diagnosis is obscured

Disseminated sclerosis is an outstanding example in point, for in this disease quite frequently one of the earliest symptoms, or indeed the only symptom is acute bulbar neuritis, indistinguishable from that due to sinusitis. However, the acute optic neuritis of disseminated sclerosis usually clears up in a few weeks, the disease itself is very slowly progressive and, so far, treatment of no avail.

Retrobulbar neuritis is, however, quite another matter when it is due to infective sphenoidal sinusitis, not only as a menace to sight but also on account of grave risks from widespread blood-borne infection. In these circumstances it is wrong to watch and wait, for the importance of early diagnosis of sphenoidal sinus infection is enforced by the good results from its disinfection and drainage.

Towards the close of the last century frequent cures of canalicular optic neuritis following operation on the sphenoid and ethmoid cells were being reported, some of them cases in which no nasal discharge could be found. How to avoid needless operations when such cases were referred by ophthalmic and other colleagues—and, be it noted, without any such assistance as we may obtain in these days, from radiology—was really a problem. In my difficulty I be thought myself of bacteriological examination of samples aspirated from the sphenoidal sinuses so as to identify the pathogenic organisms, if present, and furthermore obtain irrefutable proofs of inflammatory reaction in the presence of polymorphonuclears and phagocytosis of the organisms and thus, having excluded possible error from accidental contamination, to differentiate the really infected sinus cases from the non-infective cases appertaining to neurology.

Since that time observations, conspicuously the researches of E. D. D. Davis, have proved the sinuses sterile in disseminated sclerosis, but on the other hand others, including myself, have recorded plentiful examples of retrobulbar neuritis due to sphenoidal sinusitis, which rapidly yielded to disinfection and drainage, the results being demonstrated and measured by the ophthalmic surgeon.

With the recent improvements in radiological technique and the help afforded by endo-rhinoscopy as well as by suction-exploration, there is little excuse for allowing cases of retrobulbar neuritis to drift without endeavouring to reach a correct differential diagnosis of its cause, and so distinguish those patients for whom the rhinologist can do so much good from those for whom the physician can do so little.

T. H. Whittington : One of the charms of ophthalmology is that it frequently leads to interesting "team work," and this is so in the study of retrobulbar neuritis. Foster Moore, in the second edition of his "Medical Ophthalmology," states that he has not seen a case in which he was fully satisfied that the condition was due to para-nasal sinusitis. Adie would have us believe that the great majority of cases seen by ophthalmologists are due to disseminated sclerosis. You, as rhinologists, have operated on cases in which you feel that sight was restored by your skilful treatment. Personally I have no doubt you are right. On the other hand, I do not remember a case of retrobulbar neuritis being referred by the rhinologist, but I not infrequently refer them to you.

The optic nerve is not homologous with the other cranial nerves. The first two neurones in the course of the visual impulse are situated in the retina, which is itself an outgrowth of the brain, and the fibres of the optic nerve are therefore an association tract, and may be considered an outlying part of the brain. These fibres, like those of the central nervous system, have no sheath of Schwann, are supported by neuroglia, closely surrounded by the pia arachnoid, and bathed in cerebrospinal fluid, and the whole is surrounded by a tough dural sheath, from which, as in the spinal cord, connections cross the subdural space. As regards the sinuses, it is not in the cases with obvious purulent infection that the optic nerve is affected. It is in the chronic cases in which the infection passes through the bone—often of paper-like thinness. Plastic inflammation occurs between the dura and the pia arachnoid, as it may occur in disease of the spine, and by the combined effect of local pressure and

local toxins, function is diminished. It is when the highly susceptible papillo-macular bundle (here in the centre of the nerve) is affected that the rapid loss of vision is noted by the patient.

What are the signs that would lead me, as an ophthalmologist, to suspect some such process, and therefore urge my rhinologist colleague to operate when he perhaps reports a "normal nose." An analysis of the visual fields is the important thing. In the usual case of retrobulbar neuritis characterized by sudden unilateral loss of vision, with absence of—or scarcely any—signs at the optic disc, central scotoma, marked paracentral colour scotoma, and the peripheral field not affected—nine times out of ten we should be right in supposing it would recover spontaneously. But if there is a marked contraction of the peripheral field, signs of peripheral nerve bundle defects, and especially if these connect up with the central scotoma, then I visualize how these are being caused by a process outside the nerve and ask the rhinologist to go ahead. It is taken for granted that the fields of both eyes are examined and all other general examinations made.

T. C. Graves: Nasal sinus disease, and particularly sphenoidal disease, may cause, in addition to irritation of the peripheral sensory nerves and end-organs, cerebral and endocrine dysfunction, and thus produce varying degrees of disturbance of the intellectual life, the basal feeling-tone and the primitive instinctive mechanisms—especially that of self-preservation—causing the subject to descend to lower levels of mental as well as physical efficiency.

These conclusions have followed an investigation into sinusitis in cases of mental disorder in the Birmingham Mental Hospitals during the last seven years, an investigation inspired by the counsel and carried out with the assistance of Mr. Musgrave Woodman and his colleagues.

The observations thus made were published in the *Journal of Mental Science*, 1932, lxxviii, 459.

The sequence of symptom-groups involving the nervous system, as an untreated sinusitis progresses, may be, if the patient survives, sensory, motor, metabolic, instinctive, feeling-tone, conative and intellectual disturbances, the last including disorders of attention, memory, judgment, perception and cognition. In the more advanced acute stages of the illness, associated sensory disturbances caused by sinus disease, are perceived as hallucinations; thus tinnitus aurium becomes imaginary "voices," whilst the delusions expressed in the acute and chronic stages are determined by the endogenous disturbances of feeling-tone and instinct.

A total of 1,225 cases, 601 male and 624 female, have now been investigated by the Watson-Williams technique of suction exploration. Generally more than one sinus is involved in these psychotic cases. Out of a total of 1,001 cases in which positive clinical evidence was present, the number of sinuses involved in individual cases was:—

One sinus in 277 cases, i.e. 28%,; two sinuses in 288; three in 151; four in 148; five in 64; six in 73.

The incidence of involvement of the sphenoidal sinus is about half that of the antra. Antra alone or with others in 785 cases—397 males and 388 females. Ethmoids alone or with others in 493 cases—247 males and 246 females. Sphenoids alone or with others in 352 cases—178 males and 174 females.

Whilst mental symptoms are not pathognomonic of disease of any one sinus, they seem to be much more pronounced in cases of disease of the sphenoidal sinus.

In some cases treatment of the disease may be followed by rapid diminution—having regard to the duration of the disease—and permanent disappearance of mental as well as allied symptoms, in other cases relapses are liable to occur. These relapses of psychotic symptoms are, however, the result of re-activation of the disease process or its extension to another sinus such as the sphenoid, and compare with the recurrence of headache in cases without psychotic symptoms.

In a case, notes of which are given below, the final inclusion of the sphenoidal sinus in the sinusitis seems to have been responsible for the appearance of a particularly severe psychotic state. This case also illustrates the appearance and amelioration of psychotic symptoms in relation to the colder and warmer months of the year respectively, and their disappearance following drainage of the diseased sinuses.

A chocolate grinder, aged 46, of good stock, was admitted to the mental hospital, January 24, 1929 (first certification). Severe influenza early in 1927 had been followed by an extremely depressed state, from which he had recovered by the following August. Early in 1928 a cold had been followed by another period of depression, and even by the next August he had not recovered as substantially as in the preceding year. With the return of the cooler months he again became depressed, and in spite of rest, and of hospital and convalescent-home treatment, psychotic symptoms of depression, fear, and confusion, continued with increasing severity until, and after, his admission to the mental hospital. His weight, which had fallen to 8 st. 10 lb., from an average of 13 st., fell further to 8 st. 5 lb.

On February 25, 1929, suction-exploration of the sinuses revealed bilateral antral and right sphenoidal disease. The three sinuses were drained intranasally and the diseased tonsils were removed. Gradually, during the ensuing warmer months—especially after a course of non-specific protein therapy—the patient improved, physically and mentally, and was discharged on October 10, 1929, from the mental hospital. He returned to work with the same firm, with whom he is still working. He has now passed through four winters without relapse and has regained his normal weight.

F. A. Pickworth (Birmingham) said that several years ago, as assistant to the late Sir Frederick Mott, he had begun the study of the pituitary gland in cases of mental disorder. Almost by accident it was noted that the adjacent sphenoidal sinus often contained pus. Since then as Director of the Joint Board of Research for Mental Disease, he had made the study of the sphenoidal sinus one of the chief lines of research of the Joint Board; of 317 consecutive post-mortem examinations, in no fewer than 100 was there some evidence of chronic infection of this sinus.

He showed a coloured sketch of a chronic infection of the sphenoidal sinus which contained yellow pus. Near by were to be seen the pituitary, the carotid arteries, and a portion of the gasserian ganglion. It illustrated the anatomical possibility of chronic extension of the sepsis into (1) the most important endocrine gland of the whole body; (2) the blood supply of the brain; (3) the intercranial nerve structures.

Sluder (1910) had shown that cocaine, applied to the wall of the sphenoidal sinus, anæsthetized the central root of the fifth nerve, and it was therefore reasonable to infer that soluble bacterial products contained in the septic sinus shown would diffuse into the same structures in a manner similar to cocaine. Such absorption would account for the finding in mental hospital patients of (1) endocrine disturbances, by the action of toxins upon the pituitary gland; (2) nerve pareses and reflex phenomena, by the action of toxins on the nerve trunks; (3) histologically demonstrable vascular changes in small vessels of the brain, by the action of the toxin on the adjacent carotid arteries.

Not only toxins, but organisms themselves occasionally reached intracranial tissues from an infected sinus. Acute extensions being often fatal, such invasion by organisms was self-evident, but he thought that less severe, recoverable extensions were by no means uncommon. He had many times found organisms in the pituitary capsule, and in one case these were definitely associated with large masses of colloid, in which were embedded myriads of diplococci within the gland. A picture illustrated a large mass of colloid which separated the anterior and posterior lobes of the pituitary. This anatomical division of the gland constituents was found in several instances, but its significance was as yet doubtful; however, a correlation might be made with the clinical condition of Simmond's disease, in which severe wasting occurred.

Another specimen showed, in serial sections, the extension of diplococci into the sheath of the optic nerve.

Extensions of sepsis into the cancellous portions of the sphenoid were quite common; such were very tardy of resolution; the sinus membrane might be the first to resolve, so that streptococci were demonstrable in the bone when the sinus membrane seemed normal. As with other bone affections, these might remain latent for long periods, and were rarely associated with pus; tissue reaction seemed to be of the nature of a degenerative atrophy of the surrounding vessels, etc.

A specimen illustrated hyperplastic sphenoiditis associated with a perivasculitis of the carotid arteries of both sides. As all the toxic material, which was absorbed into the artery, was passed to brain tissue, where it was fixed by the lipoids, the correlation of the pathology with the clinical condition of violent mania associated with Huntington's chorea presented no difficulty.

A specimen was shown of a sphenoidal sinus containing pus. The carotid arteries were actually visible through the posterior wall of the sinus, and showed atheroma and irregularities of calibre; even supposing that an unrecognized cause of general arteriosclerosis co-existed there could hardly be any doubt that the sinus condition contributed to the pathological changes in the cerebral arteries.

T. B. Layton said that chronic sphenoidal sinus suppuration must be very rare; he had never yet absolutely assured himself that he had seen such a case.

That brought one to a consideration of the criteria on which the diagnosis was made. There was, on one hand, the diagnosis according to P. Watson-Williams, and, on the other hand, the diagnosis according to Hajek. According to the latter, it was necessary to remove the back end of the middle turbinal bone, and then, a fortnight later, to examine the nose and to deal with the pus in the superior meatus, in the same critical way as one dealt with pus in the middle meatus when diagnosing an anterior sinusitis and to see whether it returned after it had been wiped away. If it did, one suspected that it came either from the sphenoidal sinus or the posterior ethmoidal sinus, and then by putting a little plug into the opening of the sphenoidal sinus and leaving it there from twelve to twenty-four hours one made the diagnosis on what was then found. The question as to whether chronic suppuration of the sphenoidal sinus was common or was extraordinarily rare depended on which of the diagnostic methods which he had mentioned one was prepared to trust. He was not prepared to trust the Watson-Williams method of diagnosis by itself. It might be of value for leading one down to those cases which should be critically examined by Hajek's method, but the Watson-Williams method should not be used alone to diagnose suppuration of the sphenoidal sinus, and any work based upon that diagnosis could not be accepted. The report of the Board of Control stated that everyone doing this work must indicate in his report the exact technique upon which he had based his diagnosis, and unless in his (the speaker's) remaining years of practice he had reason to change his views, he would look with extreme scepticism upon work which had not been based upon the more careful and accurate diagnostic method laid down by Hajek, or upon some process closely resembling it.

W. S. Thacker Neville said that several years previously Proetz, of America, had stated that one could suck air out of a sinus and replace it by drugs. Le Mée had introduced this method into France, and showed many cases in Paris. If it was true that one could suck air out of a sinus and put drugs in, it was better to do this than to give a spray of ephedrine. Every nasal patient who came to his (the speaker's) out-patient department was submitted to this method of investigation, whatever might be the matter with him. He cocainized the nose slightly, and the patient lay on a couch with the head back and the chin in line with the external auditory meatus; he then put in equal parts of lipiodol and olive oil, shut the opposite nostril, and asked the patient to say "K"; he used 10 lb. negative pressure. Then, by making the patient assume various postures, he induced lipiodol

to enter the sphenoidal, maxillary and ethmoidal sinuses. He had never got it into the frontal sinus except in one case, on which he had already operated. The method was useless for diagnosing the thickness of the lining membrane of the sinuses, as the sinuses could not be filled by this procedure. As drugs could be made to stay in for four or five days, it was a good plan to fill the sinus periodically with ephedrine sulphate (8 c.c. of a 0·5 per cent. solution in saline) or with liquid paraffin. Lipiodol was used merely for investigation, and was useless for treatment. A pressure of not more than 1 lb. should be used at first in an acute case. An increase up to 10 lb. was quite bearable as the patient's condition improved.

J. A. Gibb said that he agreed with Mr. Layton. He had performed more than 2,000 operations on the nasal sinuses, but only six on the sphenoid, and in not more than twelve cases had he found disease in the sphenoid. He had operated in nine cases of retrobulbar neuritis, all cures. He had shown one at this meeting here to-day which had the classical features of retrobulbar neuritis. The vision was $\frac{6}{36}$ in the right eye, $\frac{6}{6}$ in the left, and in both eyes there was a complete scotoma for colours. Pus was exuding from both sphenoids; they were both opened, but with no result. In both maxillary antra there was pus; both were opened, with no result. The patient was sent for a time to a convalescent home, and returned with the vision worse. After allowing the patient to rest, he opened both anterior ethmoids, with the result that there was a rapid recovery of vision.

E. D. D. Davis said he still maintained that in retrobulbar neuritis arising from nasal disease there were changes in the optic disc, and that it was an optic neuritis rather than loss of sight without physical signs. In such cases the disease in the sphenoid or posterior ethmoidal cells was obvious to the rhinologist. Œdema and pus could be seen in the sphenoidal region, and these sinuses would then be explored and drained. He did not consider that in cases in which there were no physical signs and the skiagrams and aspiration were negative, retrobulbar neuritis was caused by nasal disease. Even then, if the neuritis progressed, the posterior nasal sinuses could be explored.

Œdema of the eyelids and of the orbit, diagnosed as orbital cellulitis, was sometimes treated by extensive incisions along the supra-orbital and infra-orbital margins, which led to permanent œdema of the lower eyelid and disfigurement. The majority of the cases of orbital cellulitis were due to nasal suppuration, and the nose should be attacked first and, at a later stage or if necessary at the same sitting, a limited incision could be made at the inner canthus of the eye, particularly if there was displacement of the eyeball.

W. Stirk Adams said the only facts which would convince Mr. Layton were those of morbid anatomy. If Mr. Layton would carry out serial post-mortem examinations in hospital, opening every sphenoid whenever the head was being investigated, he would find more cases of sphenoidal sinus suppuration than he had been diagnosing. He (the speaker) had used the Watson-Williams technique, which had been taught to him by the President, and he had seen no reason for mistrusting it. Suppuration was not, however, the only evidence obtainable of inflammation; there occurred a thickening of the lining membrane, which had not so far been mentioned; that thickening, if present, could easily be felt by means of a trochar placed in the sphenoid.

Bedford Russell said that at St. Bartholomew's Hospital extensive use had been made of the Proetz displacement method, from the diagnostic point of view, by the introduction of lipiodol. It was easy to discover a thickened lining membrane, and to find whether lipiodol was retained for longer than the 72 hours which Proetz had laid down as approximately the normal time. The method had also been used in the hospital for the treatment of headaches apparently due to sphenoidal or posterior ethmoidal disease. In some cases headaches had been cured easily by three instillations of ephedrine and saline.

CASES.

Sphenoidal Sinusitis.—MUSGRAVE WOODMAN (President).

J. S., 39, male, was admitted with a probable diagnosis of an intracranial neoplasm. He complained of headaches which had been increasing in intensity for four years, causing some vomiting, affection of speech, and increased prominence of eyes.

On examination.—A bad deviation of the septum to the right side was found, making a view of the posterior sinuses impossible on that side. A skiagram showed dullness of the right antrum and sphenoid.

The septum was straightened and was found to have entirely prevented drainage on the right side. The right sphenoid was drained.

The symptoms definitely diminished after a few days. A fortnight ago the patient reported that he was perfectly well, free from pain and back at work.

Sphenoidal and Ethmoidal Sinusitis with Hemianopsia.—MUSGRAVE WOODMAN.

H. W., female, aged 56, came to hospital complaining of severe pain round each eye, frontal headaches and defective vision.

On examination.—A bilateral papillœdema was found most marked on the left side. This disappeared but a bi-nasal defect of the visual field remained. There was some post-nasal infection, the left antrum was dull on transillumination and a skiagram showed some haziness of the left posterior ethmoidal region.

On examination of the sinuses by suction puncture the wash-out from the left sphenoid was found to be hæmorrhagic. Cultures were made from the contents of the different sinuses, and *Staphylococcus aureus* grew on those from the left ethmoid and sphenoid. The pain diminished afterwards and there was some improvement in vision.

A fortnight later the left sphenoid was again washed out and a radical operation was performed.

The pain entirely disappeared after this and when the patient was seen a week ago the visual fields were almost normal.

Polypoid Ethmoiditis associated with Ipsilateral and Progressive Loss of Vision.—F. J. CLEMINSON.

Female, aged 56. In November, 1923, this patient consulted Sir Arnold Lawson on account of failing vision in the right eye, with signs of retrobulbar neuritis. There was a long history of "nasal catarrh," for which she was referred to the exhibitor. The right side of the nose contained a mass of polypi bathed in pus and arising from the ethmoid.

At operation the ethmoid was exenterated and the orbital plate, like most of the remainder of the bone, was found to be carious, and a small area of orbital fat was exposed. An orbital abscess developed and was opened by Sir Arnold Lawson six days later. Three weeks afterwards the patient was discharged healed. The vision had recovered its normal acuity in January, 1924, and there has been no recurrence of the polypi. During the last year she has had what she describes as occasional slight "giddiness."

Right Sphenoidal Sinusitis.—A. LOWNDES YATES.

Female, aged 38. Pain over right frontal and right occipital and mastoid region, six years ago. Pain ceased for two years after submucous resection of the septum and then recurred and was treated by repeated applications of cocaine. Injection of the sphenopalatine ganglion was refused by the patient. When first seen one year ago, 1 c.c. of pus was washed out from the sphenoidal sinus and this was followed by relief of symptoms for one year. Three months ago the pain returned and was treated three weeks ago by displacement with relief of symptoms. All instrumental measures in the nose have caused reaction and the lysozyme factor in the discharge is low, the micro-organisms multiplying in the fluid.

Section of Comparative Medicine.

President—W. Horner Andrews, M.R.C.V.S.

[*March* 22, 1933.]

DISCUSSION ON DEFICIENCY DISEASES.

Sir Arnold Theiler said that he proposed to discuss mineral deficiency diseases in some of the larger domesticated animals by demonstrating a series of lantern slides:—

(1) A typical case of osteophagia in cattle. The habit of chewing bones was one of the first symptoms of aphosphorosis or phosphorus deficiency. Low phosphorus was a characteristic of soils and pastures in South Africa, and in many areas became the direct or indirect cause of disease. (2) A case of "Lamsiekte," a fatal disease of cattle which had proved very baffling until it was linked up with osteophagia. The immediate cause of death was poisoning by the toxin of *Clostridium botulinum*. When animals died, from any cause whatever, under ranching conditions of farming, many of the carcasses were simply left to rot on the veld. If a carcass happened to become infected with *Clostridium botulinum* the skeletal débris became very toxic. Normal cattle would of course not eat such débris, but if they developed osteophagia they did so and then died of botulism. The remedy was to feed sterilized bone meal to the cattle to prevent abnormal bone chewing, and to reduce the amount of toxic débris by burying animals which died on the veld. (3) A further stage of aphosphorosis in cattle, in which stunted growth and general malnutrition were obvious. (4) Two cattle of the same age were shown side by side, both limited to the natural pasture but one supplied with a daily supplement of a few ounces of bone meal. The difference was very striking, the bone-fed animal being nearly twice the weight of the one which was suffering from aphosphorosis. (5) The disease known amongst the Dutch farmers as "styfsiekte" or "stiff-sickness." This was an extreme form of aphosphorosis and corresponded to the diseases osteomalacia and rickets. Examination of bone sections clearly showed osteomalacia if the animal was adult, and rickets if the epiphyses had not yet closed. (6) There were depicted animals used in the experiments on the minimum mineral requirements of cattle, carried out by Theiler, Green, and du Toit in South Africa to clear up the ætiology of the naturally occurring disease "styfsiekte." The experimental ration was deficient in phosphorus but adequate in other respects. The similarity between the experimentally produced disease and the naturally occurring disease was pointed out. By comparison, control animals on the same ration, except for the addition of phosphorus in the form of bran or of bone meal, were perfectly healthy. Attention was drawn to the fact that the ration of the heifer receiving bran contained calcium and a large excess of phosphorus, the ratio CaO/P_2O_5 being 1 to 3, but that had not proved disadvantageous. In these experiments the basal ration was very deficient in vitamins, but so long as the minerals were sufficient the cattle remained healthy and developed normally. Hence, an exogenous supply of vitamins was apparently unnecessary for cattle, as was originally shown by Theiler, Green, and Viljoen, eighteen years ago when cattle were fed on polished rice for over a year, with, in addition, only 2 lb. of poor-quality straw autoclaved at 130° C. as roughage. These experiments had been amply confirmed in recent years by American workers. Young calves apparently did require a small amount of vitamin A, but even wheat straw supplied sufficient for their needs. The question of vitamin D did not arise in these experiments, since the cattle were exposed to bright sunshine all day. Reference was made to recent American work in which a calf was brought up in the dark on an ordinary ration of grain and hay, and in due time produced a calf. This showed that such a ration contained sufficient vitamin D, and that the factor of ultra-violet light, so important

in connection with human rickets, was less important for cattle. (7) A heifer was depicted, which had increased in weight from 350 lb. to 1,100 lb. on a ration poor in calcium, less than 9 grm. CaO per day. This experiment had been designed to produce an acalcicosis, or calcium deficiency disease, and although that object was not achieved, the experiment was of value in showing how low the minimum calcium requirements of growing cattle were. Microscopic examination of the bones of this animal showed that there was no storage of surplus calcium phosphate but no skeletal disease beyond a slight osteoporosis. The deduction was that the calcium requirements of cattle were much lower than their phosphorus requirements. (8) X-ray photographs, and photomicrographs of sections of bones of the experimental animals were shown. From these it could be seen that the experimentally produced aphosphorosis was identical with rickets and osteomalacia, and that these diseases were produced in nature by phosphorus deficiency and by nothing else. (9) A chart was displayed which depicted the weight curves of animals pastured upon a phosphorus-deficient veld which gave rise to osteomalacia. One group of animals were controls and received the natural pasture only; the weight charts reflected their malnutrition. A second group received a supplement of bone meal (calcium and phosphorus), while a third group received a supplement of bran (rich in phosphorus, but poor in calcium); both of these groups thrived very well. The animals forming a fourth group received a supplement of chalk, and these were in worse condition than the controls. These charts showed that phosphorus, and not calcium, was the limiting factor under natural conditions, although from analyses of the pasture, deficiency of both calcium and phosphorus might have been assumed. (10) A bone disease of a different type, which was termed "osteodystrophia fibrosa." This occurred in horses and mules, and was commonly called "equine osteoporosis." Microscopically, however, the condition was not one of osteoporosis, and the bone structure was seen to be an emergency one in which fibrous tissue predominated, and for which the term "osteodystrophia fibrosa" should be used. Sturgess, in Ceylon, had done pioneer work in clearing up the ætiology of this disease. In early days in South Africa, Theiler had regarded this disease as infectious in origin, but it had now disappeared completely from South Africa. Most of the sections shown were from cases in Ceylon which were provided by Sturgess, who had produced the disease experimentally by feeding on a ration very rich in bran and therefore with a very wide Ca/P ratio. Nimi, in Japan, had since set up the disease by feeding a ration of grain, and still more recently it had been produced experimentally in the Philippines on a ration in which the Ca/P ratio was 1 : 3. The disease apparently occurred on diets low in calcium and having excess phosphorus, but since no corresponding condition occurred in cattle it would appear that bovines and equines reacted differently to deficiencies and mineral imbalances. In grazing cattle true rickets and true osteomalacia were met with as a result of phosphorus deficiency in the pasture, but these diseases were not seen in equines in the same areas. In equines fed on excessive amounts of cereals or bran, and roughage low in calcium, the disease osteodystrophia fibrosa occurred, a disease not known in bovines. In neither of these animal species were any of the vitamin deficiency diseases seen.

Professor S. J. Cowell: I propose to deal with deficiency diseases which occur in man, and particularly with those which may be associated with dietary faults in our own country.

The possibility that a characteristic disease or group of symptoms can arise purely on account of a deficiency of some essential constituent in the diet is a comparatively modern conception in medicine. Perhaps the simplest example of a deficiency disease in human beings is scurvy, in which the evidence seems clear that the whole clinical picture is due to the lack of anti-scorbutic vitamin in the diet. In recent years many additions have been made to the number of diseases that may be classed as deficiency

diseases; many of them are recognized as due to deficiency of vitamins, but, as we have heard already, important deficiencies may be produced by lack of mineral elements in the diet, and this applies to man as well as to domestic animals. We recognize a type of nutritional anæmia, due to lack of iron and copper in the diet. Endemic goitre is another example of a mineral deficiency disease, for if it is not always caused directly by, it is related to, a deficiency of iodine. There are some diseases recognized as deficiency diseases which probably have a complicated origin. When the diseases beri-beri and pellagra were first definitely related to specific faults in diets, there was a lack of agreement as to whether deficiency of some essential food factor was the sole cause of the diseases, or whether some toxic component of the diet was primarily responsible; even to-day the problem has not been definitely settled.

The diseases which we may consider to be deficiency diseases include, therefore, first, those which are pure deficiency diseases, and secondly those which may be due to a simultaneous defect of some essential constituent in the diet, and the presence of a positive harmful agent which would normally be neutralized by the deficient factor. This conception is well illustrated by the recent work of Mellanby on the effect of such toxic agents as ergot and the lathyrus pea on the nervous system. He has shown that these agents can produce degeneration in peripheral nerves and the tracts of the spinal column, leading to peripheral neuritis, inco-ordination and paralysis. But the toxic effects of these substances can be completely neutralized by an adequate supply of fat-soluble vitamin A in the diet. It appears reasonable to regard these intoxications which occur in human beings as deficiency diseases, because if an ample supply of vitamin A is present in the diet, they will not develop.

Lastly, there are diseases which may be produced by some toxic or infectious agent, but which are more likely to appear in people whose tissues have developed imperfectly for the reason that their diet had been defective in some special respects in earlier life. In this connection I would refer to dental decay. Impressive evidence has recently been obtained by Mrs. Mellanby to show that the liability of the teeth to decay depends largely on the structure of the teeth, which, in turn, depends on specific dietetic factors controlling the calcification of the teeth.

Then again, much work has been done, which will be mentioned in detail by other speakers, on the relation between deficiency of fat-soluble vitamins and the general liability to infections. Bacterial infections, in general, are not an expression of food deficiency, but there is some evidence that resistance to infection may be altered by the presence or absence of certain food factors in the diet.

What are the deficiency diseases at present met with in this country? I will refer, first, to diseases associated with deficiency of vitamins.

With regard to vitamin A, one of the earliest characteristic symptoms recognized as a specific effect of its deficiency was xerophthalmia. This disease is met with in our own country at the present time. Last year in a clinic in the North of England 17 cases of eye disease were found which could be directly related to deficiency of vitamin A. Xerophthalmia is often associated with another condition, acquired night-blindness, which has been proved to be associated with deficiency of vitamin A. These cases are very easily treated, and will respond in a few days to a supply of vitamin A in the diet.

Symptoms arising from deficiency of the factors comprising the water-soluble vitamin B complex are not common in this country. The disease of rice-eating populations, beri-beri, is associated with a deficiency of vitamin B1, but it is not often met with in this country. Vitamin B2 deficiency is probably an important factor in the ætiology of pellagra, but this disease is comparatively rare in this country. Recently experiments have been published indicating that in some experimental animals deficiency of vitamin B2 may result in the appearance of cataract; there are, as far as I know, no observations on human beings to suggest that a deficiency of this factor plays a part in the development of human cataract.

Deficiency of the anti-scorbutic vitamin C manifests itself as scurvy. Scurvy is still sometimes met with in this country, both in adults and children. Since steps are now generally taken to give such anti-scorbutic substances as fruit juices to children from an early age, the infantile form of the disease has been less common.

Deficiency of vitamin D, the anti-rachitic vitamin, is responsible for the development of rickets and badly formed teeth in children and is also an important factor in the causation of infantile tetany. Deficiency of this anti-rachitic factor is not necessarily a dietetic deficiency, for this factor may be absent from the diet and yet may be manufactured in the skin by exposure to ultra-violet light and sunlight in sufficient quantities to make good the deficiency in the diet. But in our country the supply of sunlight cannot be relied on to compensate children for a deficiency of this vitamin in their food, so that special steps have to be taken to safeguard children from the development of symptoms of this deficiency.

Certain mineral elements may be deficient in our diets and cause symptoms of disease. One of the most striking instances is a deficiency of iron—and possibly of copper also—in milk, leading to the development of nutritional anæmia. When infants are fed exclusively on milk for long periods, especially on cow's milk as opposed to breast milk, anæmia is liable to appear in them. Dr. Helen Mackay has worked out the prevalence of this nutritional anæmia in children. She finds that it is very common in London; more than half the children she examined who were receiving cow's milk had a definite anæmia which could be prevented or cured by adding appropriate iron salts to the diet.

There are persons who suffer from specific dietetic deficiencies, not because their diet is lacking in the necessary factors, but because those factors are not absorbed by these particular individuals. I would remind you of the deficient fat absorption in children who have cœliac disease, which is commonly associated with rickets. In such a case the deficiency leading to rickets may not be so much the defective amount of anti-rachitic vitamin in the diet, but its defective absorption, owing to the abnormal functioning of the bowel which seems to be the prime factor in the disease. In human adults there is a form of osteomalacia which is associated with steatorrhœa, that is to say, defective absorption of fats, and with it a defective absorption of anti-rachitic vitamin. Cases of deficiency diseases, for instance pellagra, have been recorded in persons who have undergone short-circuiting operations on the bowel, or who have developed fistulæ between the stomach and the large bowel.

With regard to the prevention of the conditions of which I have been speaking, this, in theory, should not be very difficult. Most of the essential food factors are present in a mixed dietary containing dairy produce, eggs, fresh vegetables and fruit, but many of these foods are too expensive to be purchased in adequate amounts by our poorer people, who are therefore liable to suffer from deficiencies of some of the essential elements which may manifest themselves indirectly, even if they do not produce typical deficiency diseases.

Dr. H. N. Green: I cannot claim any special knowledge of deficiency diseases in man for, with the exception of rickets and, more rarely, scurvy, frank deficiency disease is, so far as we know, of rare occurrence in this country. In the case of vitamin A, to which I shall confine my remarks, no case of complete deficiency leading to death has been reported in this country, though one or two cases with typical post-mortem findings have been described elsewhere. It should not be forgotten, however, that the early classical signs of this deficiency may sometimes be observed, even in this country. These cases are probably chiefly seen at ophthalmological clinics, for Spence has described seventeen cases of keratomalacia, associated with night-blindness, in a total of 4,100 eye cases. I have seen three

such cases in school children, all of whom showed Bitot's spots on the conjunctiva. These cases responded quickly to cod-liver oil and a high vitamin A diet. Spence did not find any marked evidence of susceptibility to infection in his cases, but seven out of eleven showed a form of indolent skin sepsis, which cleared up with vitamin A treatment.

Moore has recently described cases of retrobulbar neuritis, occurring in almost epidemic form amongst adolescent schoolboys in West Africa, which were apparently due to a dietetic deficiency, and which responded well to early treatment with cod-liver oil and marmite. This is particularly interesting in view of the work of Professor Mellanby, who has shown that vitamin A lack in dogs leads to marked degeneration of the afferent nerves, including the optic. The possibility should be considered that some forms of retrobulbar neuritis may be due to—or at least accelerated by—dietetic deficiency.

The susceptibility of many species of animals to local infections when the liver reserves of vitamin A are exhausted has now been amply proved. Carotene is just as effective in preventing these septic complications as is vitamin A; in fact, in a recent report by Turner and Loew, evidence that it may be more effective than cod-liver oil is presented. I have shown that this liability to local infection is also seen in the generative organs, particularly in the rat which has been pregnant. It has yet to be shown, however, in a decisive manner that vitamin A deficiency is responsible for a lowering of general resistance as distinct from local resistance, as in the latter case the infection is always associated with metaplasia of the epithelium at the site of infection.

Much work has already been done regarding the reaction of the vitamin-A-deficient animal to experimental infection. Amongst the more recent investigations, that of Lassen is the most extensive. Using a strain of paratyphoid he assessed the degree of lowering of resistance by the extent of spread of the infection in the reticulo-endothelial system. He concluded that in the vitamin-A-deficient rat this system loses its power of destroying the bacteria presented to it. The effect was more marked with oral infection, but was still obvious when infection was by a parenteral route. Boynton and Bradford, using an organism of the *B. mucosus capsulatus* group, claim to have found a lowered resistance in rats receiving a diet lacking vitamin A as early as the fourth week, whilst Zilva reported a marked lowering of resistance to infection with *Bact. suipestifer* in the vitamin-A-deficient rat.

On the other hand, several workers have failed to note any increase in resistance by feeding additional quantities of vitamin A to animals already receiving maintenance amounts of this vitamin in their diet. My own experience conforms with this, for in the rat I have not found any difference in response to infection with a lethal strain of hæmolytic streptococcus, though the dosage of vitamin A or carotene was increased to a thousand times the maintenance dose.

Naturally, possible changes in the natural and acquired antibodies in the blood of vitamin-A-deficient animals have been much sought for, but the evidence is somewhat conflicting and in the main negative. A thorough investigation of this type was recently reported by Ruth Green, whose chief positive finding was a marked lack of response in the vitamin-A-deficient rabbit to immunization with sheep or ox-red cells. There was also a slight tendency for the titre of the acquired agglutinins to *Bact. typhosus* to be lower than that in control animals. In rachitic rabbits these changes were not found.

My own work on experimental infections in vitamin-A-deficient animals has been extensive but inconclusive. This kind of investigation is not so simple as it might appear, for it is necessary to control with care the tendency of the deficient animal to die from deficiency disease alone. With acute infections, due to colon organisms, results were completely negative from the standpoint of mortality

rates. Later, a more chronic type of infection was tried, using a strain of hæmolytic streptococcus (Arenson-Warmerscher). The details are far too numerous to quote, but many series of deficient animals showed a higher mortality rate and lower survival time than did the control rats. In a few series this difference was very striking, but in other apparently similar experiments little difference was noted. A statistical analysis of the results did not warrant the conclusion that there is a marked fall of resistance in the vitamin-A-deficient rat.

It appeared that a still more chronic infection, induced in an animal whose diet was only partially deficient in vitamin A, would tend to show any possible fall in resistance more definitely. To this end, work was undertaken with the tubercle bacillus as infecting agent, and it was finally found possible to produce infection in the normal rat in a considerable percentage of cases, though this animal is usually highly resistant to this organism. However, the results were mainly negative, and no definite fall in the resistance of vitamin-A-deficient rats to tubercular infection was observed. In a few instances an enormous infection was seen in adult rats which had been given a vitamin-A-deficient diet for long periods, but similar gross infections were also noted occasionally where very large doses of cod-liver oil had been given. Deficiency in the vitamin B complex, or in both vitamins A and B, and also a gross quantitative restriction in a complete diet, all appeared to lower the resistance of the rat to tubercular infection. It was also observed in the rabbit that a large increase in the vitamin A, B or D supplies, given either by mouth or intravenously to the rabbit on a normal diet did not materially affect the survival time or the extent of the lesions resulting from intravenous infection with bovine tubercle bacilli.

A fair appraisal of the present position regarding our knowledge of experimental infection and vitamin A deficiency would appear to be as follows : There is probably a slight lowering of the general resistance to all types of infection. There is possibly a more marked lowering of resistance to certain types of organisms, particularly to those which chiefly invade regions lined by mucous membrane.

I can only touch on the question of human infections and their response to vitamin A treatment. During the outbreak of xerophthalmia amongst children which occurred in Denmark after the War, Bloch observed the marked prevalence of urinary tract and respiratory infection. Whilst 80% of vitamin-A-deficient children were found to be infected, only 30% of scorbutic cases were infected. Professor Mellanby and I have shown that the addition of extra amounts of vitamins A and D to the diet of pregnant women appears to reduce the tendency to puerperal sepsis. We have also found a diminished mortality-rate in puerperal septicæmia, which was apparently due to treatment with vitamin A preparations. In a series of eighteen cases in which positive cultures of the hæmolytic streptococcus were found during life in the blood, only five deaths occurred. It must be admitted that some of these cases were clinically not severe, but even if only definitely severe cases are included there were five recoveries in eleven cases of septicæmia (including one staphylococcal case, which died). Out of a total of sixty-one cases, clinically diagnosed as septicæmia during three years at the same hospital, thirty-four were treated with vitamin A, with a mortality-rate of 38%, whilst twenty-seven were untreated for various reasons, with a mortality-rate of 70%. This apparently favourable effect has not, however, been confirmed. Miss Thompson, working at Glasgow, found no diminution in the mortality-rate as a result of this treatment, only two recoveries occurring in eighteen cases of septicæmia. She thinks that, whilst vitamin A may increase the resistance in mild cases of puerperal sepsis, it is of no value in severe cases. Dr. Colebrook, in a smaller number of cases, has also not confirmed our results.

The difference in results may be fortuitous or it may be due to some factor in our mode of treatment which was not duplicated in other investigations, such as the

nature of the general diet or the earlier onset of treatment, but I feel that investigations on these lines should continue, and that in future work particular attention should be paid to the diet of the patient, especially in regard to the supply of ample protein and calcium, and perhaps vitamin B. The question of the absorption of the vitamin preparations should also be considered. My findings in the livers of women dying from puerperal sepsis show that a fair proportion are devoid of, or contain only minimal quantities of, vitamin A. In thirteen cases I have examined since the publication of the preliminary findings, five have shown very low reserves of vitamin A. This fact alone indicates that the diet of these women did not contain sufficient vitamin A, and probably therefore did not contain other essential food factors. It is important also to note that a marked lowering or complete absence of vitamin A reserves can apparently occur in man without any frank signs of vitamin A deficiency appearing.

The findings of Moore, Wolff and myself show that large vitamin A reserves may co-exist with severe grades of infection. Future workers must realize that vitamin A is not specific or even of value against all types of infection, and they should concentrate on finding the type in which it is beneficial. Negative results have been reported by Orenstein in the treatment of lobar pneumonia, and by Barenberg and Lewis in the respiratory infections of children. On the other hand, Ellison has recently reported definitely favourable results in reducing the death-rate from measles.

The more one sees of spontaneous infections arising in badly fed animals, the more one is impressed that this must be of some significance in human infections. All who work with experimental animals, particularly the rabbit and guinea-pig, know their marked tendency to infection when green-stuffs are lacking in the diet. The future will probably show that vitamin A is of significance in human infection, but more particularly in association with other factors in the diet. The physiology of this vitamin is almost unknown; its mode of absorption, the mechanism of its release from the liver into the blood-stream, and its significance in terms of biochemistry must all be determined before we can evaluate its possibilities in the prevention of disease.

Mr. M. C. Franklin (Canterbury Agricultural College, New Zealand): The districts in New Zealand in which deficiency diseases occur are fairly restricted in area. The diseases can be classified as follows: (1) Iodine deficiency; (2) Bush sickness (iron deficiency); (3) Mairoa disease (lime deficiency); (4) Wairarapa disease (Waihi disease) (phosphate deficiency); (5) Miscellaneous diseases, such as xanthin calculus formation in the kidneys of sheep.

(1) *Iodine deficiency.*—A detailed investigation of the iodine content of the soil of various areas has revealed a deficiency of iodine which, with a few exceptions, can be correlated with the occurrence of goitre in children [1]. In stock animals it has not been possible to show that ill-effects follow a deficiency of this element. Thus, in 1929, an experiment [2, 3] with approximately 160 sheep was commenced at Canterbury Agricultural College, on land which was considered to be iodine deficient. The animals were divided into two groups, one group being treated regularly with potassium iodide *per os.* Records of the live weight of the ewes, hoggets and lambs, lambing returns and wool returns from dosed and control sheep have been kept. Examination of the records dealing with live weights, lambing returns and amounts of wool, so far, show that treatment with iodine has no influence on sheep grazing on a land reputed to be iodine deficient.

(2) *Bush sickness (iron deficiency).*—This condition is identical with that known in Scotland as "pining" in sheep, as "nakuruitis" in cattle, in Kenya, and as "coast disease" in cattle, in Tasmania. Work on this disease was begun in 1900 by Aston, who considered it to be due to iron deficiency of the pasture, on account of the severe anæmia associated with it. Further work extending over

a number of years has verified this, and curative and preventive methods are now available. Originally, phosphate of iron was used for treatment, but in 1918 this was replaced by iron ammonium citrate. As both these forms of treatment are expensive, Aston, in 1925, began to use ground-up iron ore as a preventive. In 1927, in consequence of the marked success achieved by Orr in the use of Scottish bog-iron with cattle in Kenya affected with a disease similar to bush sickness, Aston was encouraged to continue the use of spathic iron ore, and later powdered limonite (hydrated iron oxide), mixed with salt, as a lick for breeding ewes and lambs. An account of the success attending these preventive measures has been published [4].

(3) *Mairoa disease or "Mairoa dopiness."*—In this area of country in the central part of the North Island, sheep are liable to suffer from malnutrition, with general lightening of the bones, and unless removed to healthy pastures they eventually die [5, 6]. The condition is considered by many to be due to a lime deficiency in the pasture. Curative measures consist of dressing the land with about two tons of lime to the acre or with a mixture of 5 cwt. of lime and 2 cwt. of superphosphate.

In the investigation of bush sickness and Mairoa disease the New Zealand Geological Survey Department has greatly assisted in mapping out the areas affected. These occur in what was originally an area of considerable volcanic activity and which is now covered with the debris or "volcanic ash" of a number of volcanic showers, varying from a few inches to several feet in depth. This now forms the surface soil on which the vegetation in many areas has to grow. The Geological Survey has classified the various volcanic showers. That on which bush sickness occurs has a low iron content. The volcanic shower (or rather series of showers) in the Mairoa area is somewhat porous in texture, and since in this district there is a fairly heavy rainfall (up to 100 inches in parts) the soil has suffered considerable leaching of its lime.

(4) *Wairarapa disease or Waihi disease.*—This is considered to be caused by a deficiency of phosphate in the pasture of affected areas. Although normally in the Wairarapa district cattle can be reared and fattened quite well, during very dry seasons malnutrition of the bones has been recorded on certain farms. Aston [7, 8] has shown that during these seasons the phosphate content of the pasture has fallen considerably (average 0·33%), and work extending over several years has shown that rainfall and phosphate content of the pasture have a more or less direct relationship, high rainfall being associated with a high phosphate content, whilst conditions of drought coincide with a very low phosphate content and the appearance of this disease in certain areas.

(5) *Xanthin calculi in sheep.*—The occurrence of xanthin calculi in the kidneys of sheep was brought to the notice of workers at the Cawthron Institute in 1929 [9]. This occurred in the Moutere Hills district of the Nelson province in the South Island, an area noted for its poor soil and pasture, both of which are low in lime and phosphate. It has been suggested that the low mineral content of the pasture may affect the purine metabolism and so give rise to the formation of xanthin calculi.

In areas where the land has been dressed with lime and phosphate the trouble has not recurred.

In October, 1931, at the Institute of Animal Pathology, Cambridge, I began to study the biochemical and nutritional effects of a low-calcium diet on sheep. Young wether lambs and fully matured ewes were kept on a low-calcium diet of 1 to 1·5 g. lime (CaO) per day, the diet in all other respects being satisfactorily balanced. Metabolism experiments were carried out on the lambs, and in the ewes the effect of successive pregnancies was studied. Bone and blood analyses were made at regular intervals. From the results obtained I feel convinced that many of the results obtained on mineral deficiency problems should be revised. I do not wish to

suggest that the condition of the experimental animals has been wrongly described, but I think the interpretation of the cause of the trouble has too frequently been incorrect because some workers have failed to realize that the diet is deficient, not only in the particular constituent studied, but often in other respects also. As an example may be mentioned the case of Mairoa disease in New Zealand. Aston gives the amount of lime (CaO) in some of the poorest Mairoa pasture as 0·7 per cent. If a sheep consumed from 2½ to 3 lb. of this pasture per day it would receive from 5·6 to 8·4 g. lime (CaO). I know personally of areas where good, healthy sheep are reared on pasture from which they would derive a smaller daily intake of CaO than this, and I therefore find it difficult to believe that the trouble is due to the pasture being low in lime. Aston has, of course, shown conclusively that the Mairoa soil *is* lime deficient, and has stated that originally, after forest burns some years ago, stock thrived there on the good type of pasture then present, but owing to the gradual leaching out of the soil nutrients with the heavy rainfall the pasture has gradually reverted to an inferior type consisting of danthonia, fog, etc. In view of this, would it not be reasonable to assume that the cause of the trouble among sheep in the Mairoa district is not a lime deficiency *per se*, but a lowered level of nutrition resulting in general malnutrition?

In my work at Cambridge, ewes which were receiving only about 1·5 g. CaO per day for the last eighteen months and which during this period have had two pregnancies are still normal in appearance. I believe this supports my opinion that the main trouble in Mairoa dopiness is due to some other factor or factors. Top-dressing with 5 cwt. of lime and 2 cwt. of superphosphate per acre cures the trouble, but this at the same time improves the quality of the pasture, so that while a manuring experiment of this nature will prevent the disease, it does not enable us to determine the cause.

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Dr. H. H. Green said that Sir Arnold Theiler, with whose researches in South Africa he had been associated, had dealt with bovine aphosphorosis but had not referred to sheep. In some areas sheep also suffered severely from phosphorus deficiency. Recently, Bekker had described "lamkruis" in the Cape Province, a skeletal disease involving fracture of the pelvic bones. In the area concerned the bones of the sheep were often fragile, and ewes seldom came into œstrum. Sheep were not bred there, but farmers brought up sheep from other areas and made use of the poor pasture for maintenance. Although the animals did not grow well, they produced a wool of peculiarly fine texture which commanded a high price on the Bradford market, and this to some extent compensated for the low yield; such wool, however, was really pathological and associated with aphosphorosis.

The relationship between aphosphorosis and fertility should also be mentioned. Both cows and ewes appeared to adjust the birth-rate to meet the occasion. There were many areas in which the phosphorus deficiency was not so acute as to produce actual disease; in these the cattle could get along in a sub-optimal state of nutrition and complete their life cycle. Under these circumstances, however, annual calving was rare—a calf every second year being the rule—and oestrum was delayed for a long time after calving.

So far as the blood picture in aphosphorosis was concerned, inorganic phosphorus was characteristically low, and was even reduced to one-fifth of the normal. So characteristic was this phosphatæmia that workers in South Africa were now

using it to map out the country in respect to phosphorus-deficient areas; instead of a laborious analysis of soils and pastures, a rapid preliminary survey could be obtained by examining the blood of grazing animals.

Professor Cowell had mentioned diseases which were not actual deficiency diseases in themselves but were nevertheless associated with diet, e.g., the association between dental caries and avitaminosis. Similar indirect associations could be quoted from the field of animal husbandry, e.g., between aphosphorosis and death from "obscure causes." Even the mortality from poisonous plants was reduced by feeding phosphorus compounds, although at first sight there was no obvious connection, the probable reason being that animals suffering from phosphorus deficiency, and showing osteophagia, lost their sense of discrimination for different plants. An extreme case of indirect operation of a dietary deficiency had been mentioned in connection with lamsiekte—botulism arising from the ingestion of toxic carrion.

Another form of indirect association related to certain worm diseases. Both in Australia and South Africa there had been reported a higher mortality from worm infestations when there was an associated nutritional deficiency, specific malnutrition probably lowering the resistance to parasites. Even in Great Britain there was ground for suspecting that certain enteritic disorders of young pigs were indirectly associated with malnutrition, although superficially they were infections of some sort.

Speaking of changes in the mineral composition of the blood associated with mineral deficiencies, it should be noted that such blood changes could also occur independently of nutritional deficiency, e.g., "lactation tetany," a condition which occurred in cows when transferred from stall-feeding to pasture. Here the change of dietary was apparently associated with the onset of the condition, but there was no evidence that it was in any sense a deficiency disease. In "lactation tetany" there was a marked fall in blood magnesium—to about a quarter of the normal value—but this was not due to any deficiency of magnesium in the pasture. In "milk fever" of cows there was a marked hypocalcæmia, which could be abolished by inflating the udder and which, therefore, had no connection with the calcium content of the food. Conversely, a peculiar hypercalcæmia was associated with "equisetosis" of cows, i.e., poisoning with *Equisetum palustre* contained in hay or silage; some time after ingestion of this plant there was often a marked rise in blood-calcium which persisted for a week or more after cessation of feeding on the plant. This had nothing to do with the calcium content of the ration, but was a toxic effect.

With regard to the failure to produce an acalcicosis in cattle, it should be mentioned that on a ration low in calcium, which caused a slight osteoporosis, there was no material fall in blood-calcium or blood-phosphorus. The blood-calcium was apparently controlled within fairly narrow limits even on calcium-low diets, so that a pronounced hypocalcæmia, when it did occur, was to be attributed to a disturbance of the physiological mechanism for regulating blood-calcium and not to low dietary calcium. It would be interesting to carry out an experiment with still less calcium in the ration than in the case referred to by Sir Arnold Theiler.

No mention had been made of iodine deficiency disease in domesticated animals. The most interesting case of this was "fœtal athyrosis" of young pigs, the so-called "hairless pig malady," which Ennis Smith, in America, had shown to be due to deficiency of iodine in the ration of the breeding sow. The young pigs were born hairless, and many died shortly after birth, and were found to have defective thyroid glands. The trouble had been abolished by the simple expedient of supplying a trace of iodide to the sows, usually in the form of iodized salt.

Mr. Franklin had cited "bush-sickness" of cattle as an iron-deficiency disease. The so-called "nakuruitis" of Kenya and "salt-sick" of Florida came into the same category, while in Scotland the sheep disease "pining" or "vinquish" was

attributed to the same cause. These diseases were characterized by malnutrition and anæmia, and could be prevented and cured by administration of iron; in New Zealand and Kenya a lick containing ferric oxide was used, while in Florida a trace of a copper salt was also added. There was still room to doubt, however, whether these diseases were due solely to deficiency of iron in the pasture, and the fact that they responded to iron therapy was not complete proof. In view of the difficulty of producing a direct iron-deficiency disease in laboratory animals one had the impression that many of the pastures concerned, although low in iron, were not so low that iron deficiency could be incriminated as sole cause. He did not wish to dispute the generally accepted view, but merely to point out that the inquiry should be carried further. Most of the work had been done by agricultural chemists, and veterinary studies were scanty. There were, for example, no records of morphological studies of the blood, and no attempts appeared to have been made to classify the anæmias shown in these diseases.

Dr. W. R. Wooldridge said that work on the pig would serve to illustrate two important deductions in regard to deficiency diseases. The first was that results obtained in experimental animals could not, without further research, be applied to other species of animals. It had already been insisted that avitaminosis was very difficult to produce in ruminants *per se*, and work on the pig had shown that with this animal it was impossible to produce vitamin C deficiency. Vitamin A deficiency had been produced after prolonged experiments, but only after keeping two generations on an A-free diet. "D" avitaminosis could be readily produced in the pig, and could be caused by a calcium deficiency, which was not the case with the ruminant. In fact pigs kept in stalls were liable to suffer from rickets, owing to the fact that their cereal diet had a low calcium content. Rickets could also be readily produced in the pig by a lack of vitamin D or absence of sunlight, whereas both these factors appear to have little influence in the ruminant.

With rickets, however, it was not simply a question of the lack of some essential dietary factor, but of dynamic equilibrium also. The essential point about bone formation was the deposition of calcium phosphate at the site of the bone, a phenomenon influenced by a number of factors. The first was the requisite concentration of the two ions, calcium and phosphate; this could not invariably be obtained by including sufficient calcium and phosphorus in the food, for the question of absorption of these elements from the alimentary tract came in. There was evidence to suggest that this absorption varied with different foods, or with the form of the calcium and the phosphorus in the different foods, while there was further evidence to show that vitamin D acted as an antirachitic agent, at least in part, because it controlled, to some extent, the diffusion of calcium through the alimentary wall.

In addition to these factors which obviously influenced the concentration of calcium and phosphorus in the blood, others were involved in the balance of the necessary elements. Thus, it might be necessary to have an optimum balance of inorganic ions, for on feeding potassium in excess to pigs receiving adequate calcium and phosphorus, it was found that the calcium and phosphorus retention was greatly decreased and that a condition not unlike rickets was produced. The concentration of the calcium and phosphate ions in the blood was influenced by the presence of an enzyme—bone phosphatase—at the site of bone formation. This enzyme converted organic phosphates into inorganic phosphates, and so increased the concentration of the latter. In this way the product of the concentrations of the phosphate and calcium ions was raised through the presence of the enzyme and, if it exceeded the solubility point, calcium phosphate was deposited from solution.

Other factors which might influence the concentration of calcium and phosphate ions in the blood were hormones, while certain forms of metabolism might have an indirect influence. Thus, sugar was metabolized through an organic phosphate

form, and hence, a variation in the sugar content of the blood would alter the concentration of the phosphate ions in the blood. This variation would influence the process of bone formation, which, as had been pointed out, depended upon the product of the concentrations of the calcium and phosphate ions. It was important then to realize the complexity of the factors involved in the ætiology of deficiency diseases. Some factors bore directly upon the problem, whilst others had an indirect influence by altering some dynamic equilibrium which itself depended upon some factor essential to the chemical changes directly concerned in the metabolism upset by the nutritional deficiency. It must be remembered that most physiological processes were dynamic, and that health depended upon the maintenance of an optimum state of equilibrium.

He would conclude by asking two questions with a clinical bearing. It was stated in the literature that lack of vitamin A led to xerophthalmia, and this was probably true in the case of human beings. In the dog there were a number of eye diseases resembling that condition, and running concurrently with such diseases as distemper. Had clinicians present found that the administration of vitamin A in such cases of distemper had any value? The other question was whether clinicians had found it useful to administer vitamin B in various nervous diseases met with in the dog, such as paraplegia which could be produced in the dog by lack of vitamin B.

Professor G. H. Wooldridge, in answer to the last two questions, said that at the Veterinary College they had regularly administered cod-liver oil in xerophthalmia and other diseased conditions of the eye, and the results had been very beneficial when this had been done in addition to local measures. As to vitamin B, the same applied, not only in paraplegia, but even more markedly in hyperæsthetic conditions of the skin, in which the animal could not bear a touch without shrinking; in a number of these cases marked improvement followed the administration of vitamin B.

Dr. H. H. Green, in reply to a question, said he did not think that milk fever had anything to do with low calcium in the ration of the cow. He considered that the hypocalcæmia of that disease was solely due to disturbance of the physiological mechanisms controlling the level of blood-calcium. In their attempts to produce a calcium-deficiency disease Sir Arnold Theiler and he had cut down the dietary calcium of two cattle to below 9 g. per day, but in spite of this the animals grew normally, showed normal blood-calcium and did not develop milk fever on calving.

Mr. Franklin (in reply) said that the Cawthron Institute in New Zealand had been carrying out important work with "bush-sick" pasture. Research workers there had found that the problem could be tackled satisfactorily by finding how much soluble iron could be extracted from the soil by N/10 oxalic acid in the area where "bush sickness" occurred. In the affected areas the iron content of the soil was low. Bush sickness was not found to occur among stock which were grazing on pasture which was growing on soil with a higher iron content.

In connection with the Mairoa disease, a theory had been advanced recently by some workers that cyanogenetic glycosides were the cause of the trouble, and that clovers contained a fair amount of these. There were reasons, however, which led him to think that the above theory was untenable and, as mentioned earlier in the discussion, he felt that Mairoa disease probably resulted from general malnutrition.

From the physiological point of view there were many features which were not yet clear, and much more work was required.

Section of Dermatology.

President—A. M. H. GRAY, C.B.E., M.D.

[*March* 16, 1933.]

? Lichen Planus: Case for Diagnosis.—H. W. BARBER, M.B.

Miss M. W., aged 52.

History.—At the age of nine she fell into a peat fire and was severely burnt, with subsequent scarring, which is evident on her arms and neck. Shortly afterwards a rash developed, from which she has never since been free. She had rheumatic fever at the age of 17. In 1916-1917 she attended St. Thomas's Hospital, was given arsenic and treated with X-rays with partial success.

She came to me first in June 1930. At that time I regarded the eruption as a very extensive and atypical lichen planus, and this view, which, I think, is confirmed by the section, I still hold.

Present condition.—The scalp is covered with psoriasiform scaly lesions, and there are large atrophic areas denuded of hair.

On the face are similar raised scaly patches and the eyelids on the left side are affected. On the body and limbs there is a widespread red and infiltrated eruption, with in parts heaped-up scales, resembling psoriasis very closely; formerly, however, the appearances were more those of a somewhat hypertrophic lichen planus. On the backs of the hands are numerous warts, and some flat, circular lesions, suggestive of lichen planus. On the palms are hyperkeratotic patches, with some circular lesions, covered with hypertrophic keratoses. The finger nails are not affected.

The soles are involved, with a diffuse scaly erythrodermia. On the neck and arms are areas of scarring with pigmentation, the sites of the burns above referred to.

The patient has had injections of enesol and novarsenobillon without any apparent effect.

Report on microscopical examination of a portion of skin excised from the thigh. The appearances are not those of psoriasis, but are those of lichen planus. There is acanthosis and hyperkeratosis, with slight parakeratosis in places. The granular layer is present, but the distribution of keratohyaline is irregular, it being abundant in some parts of the section and absent in others. The papillæ are broadened "en coupoles," and many are oblique; the interpapillary processes are irregular in shape, some being broad, others narrowed and peg-like. There is a dense cellular infiltration of the papillary layer and dermis, sharply delimited below and consisting of small round cells. The demarcation between the epidermis and dermis is in places very ill-defined, so that the cell-infiltration appears to invade the epidermis at certain points.

Discussion.—Dr. ARTHUR WHITFIELD said that it might be worth while to withdraw 8 c.c. of cerebrospinal fluid, notwithstanding the long duration of the condition. At King's College Hospital there had been a case of acute lichen planus with plaques, for about seven years, and nothing which was done influenced the patches. He (the speaker) had withdrawn some cerebrospinal fluid, but at first he had taken too little. A fortnight afterwards he

removed 8 c.c., and then the whole condition cleared up. This measure seemed to do good in practically every case.

Dr. BARBER said that he would adopt Dr. Whitfield's suggestion. Had Dr. Whitfield found that the ordinary chronic cases of lichen planus responded to lumbar puncture, or was it only in the acute cases that this method of treatment was effective?

Dr. WHITFIELD said that the chronic cases also responded to the treatment. Dr. Adamson and he (the speaker) had had a case, about the diagnosis of which they were not certain; there was much depigmentation, infiltration and a maddening degree of itching, and the condition had been present for years. He removed 8 c.c. of cerebrospinal fluid and the patient had left the nursing home three or four days later, free from itching. He had learned that the itching had not returned, and he presumed that the depigmentation was permanent. He would not be very sanguine of the result in the present case, but he would certainly make a trial.

Demonstration of Porcelain Models.—Professor SATANI (University of Osaka, Japan).

Dr. I. MUENDE said that Professor Satani made plaster casts of the condition to be preserved, then made a clay positive. This was baked at a very high temperature, and painted with lacquer. Then, while it was still wet, the Professor applied the proper colour in oils. The process was quite inexpensive. The models were hard and unbreakable, could be washed and would keep indefinitely.

The PRESIDENT said that this was a beautiful demonstration of what was possible in this way. These models had many advantages over wax ones of the ordinary kind, as they would not melt, and could be washed and kept clean. The Section was very grateful to Professor Satani for the demonstration.

Unusual Case of Arsenical Dermatitis.—A. CAMBELL, M.B.

Violet M., aged 25, married nine months.

First attended Portsmouth Venereal Centre 15.12.31.

States that shortly after marriage she had a sore on the lip, but she did not seek medical advice until symptoms of secondary syphilis were well established.

On examination.—A maculo-papular eruption was seen on the trunk, mucous patches in the mouth, poly-adenitis and condylomata. The Wassermann reaction was strongly positive.

From 15.12.31 to 6.4.32 nine intravenous injections of stabilarsan (= 4·8 grm.) and ten intramuscular injections of metallic bismuth (bismostab) were given. On 6.4.32 a skin eruption, resembling seborrhœic dermatitis, appeared. From then until 29.5.32 intravenous injections of sodium thiosulphate were given every two or three days. Towards the end of May it was evident that she had dermatitis of the type associated with arsenobenzol treatment. Abscesses in the axilla developed and had to be opened. On 15.6.32 the rash was was well established on the arms. From then onwards it seemed to subside and more injections of bismuth were given. On 31.8.32 and 26.10.32 Wassermann tests were negative and the skin condition seemed to be clearing up. She came up again on 14.12.32. The dermatitis had become much worse, affecting practically the whole trunk, thighs, arms and scalp, and the hair had come out in large patches. The distribution was patchy, except on the abdomen where the whole of the skin covering the lower portion was affected. The patches were dusky red, scaly, and slightly raised, and at first there was a good deal of itching. She had no constitutional symptoms whatsoever, and was able all the time to carry on with her work.

This case seems to present unusual features in dermatitis following administration of arsenobenzol. This complication varies in intensity from a mere transient erythema to an acute eczematous condition, followed by general exfoliation and severe illness, with either gradual recovery or, sometimes, a fatal result. Several theories have been put forward as to the causation, e.g., hyper-sensitivity of the skin previous to arsenical treatment in patients who have dermatological conditions, such as seborrhœic dermatitis, ichthyosis, eczema and psoriasis, etc. Some writers have suggested that there is a relationship between arsenical dermatitis and pre-existing foci of sepsis.

In this case the patient has pyorrhœa and she has always suffered from dandruff.

There is a form of arsenical dermatitis in which there are raised dusky-red patches, almost hæmorrhagic in appearance, which tends to spread rapidly, is accompanied by bleeding from the mucous membranes, and, in my experience, is usually fatal. I saw a case last year which had been treated with bismarsen in Sumatra. The patient's skin was almost black, the conjunctivæ were intensely red and he had bleeding from the gums. He died within a fortnight from the onset.

The patient in the present case has that type of eruption, but she has not had any constitutional symptoms. The dermatitis has never completely cleared up, but where recovery is taking place there are patches of leukoderma and intense pigmentation especially in the groins, on the abdomen, and in the axillæ.

To summarize: The unusual features are: (1) The long duration; (2) the complete freedom from general illness; (3) the recovery with formation of patches of leukoderma and pigmentation.

The urine and hair are now quite free from even the minutest trace of arsenic.

I have never seen a case like this before, and have so far been unable to find records of any similar case. I have one suggestion to make as to the cause of the pigmentation, which is uncommon in poisoning from organic arsenic. For some time large quantities of sulphur were being given to the patient—0·9 grm. of sodium thiosulphate, which is equivalent to nearly 0·2 grm. of sulphur. She was also taking sulphur by the mouth. There is good ground for believing that the liver sometimes suffers considerable damage by arsenobenzol, even when there is no jaundice. My suggestion, therefore, is that tyrosine, which is produced by damage to the liver, together with its appropriate ferment, and the large amount of sulphur she was taking, led to increased formation of melanin.

? Pigmentary and Atrophic Lichen Planus following the Administration of Arsenic and Bismuth.—LOUIS FORMAN, M.D.

Mr. D. B., aged 27.

Venereal disease, July, 1932; treated with arsenobenzol (3·6 grm.) and bismuth (2·2 grm.) over a period of two months.

Two weeks after the last injection the patient noticed irritation of the chest, and the appearance of the rash which has since involved the trunk, the proximal part of the limbs, the face, and the scalp. He describes the initial lesion as a red patch, which becomes brown in the centre, leaving a red ring at the periphery, the whole fading in two months.

There is a diffuse brown pigmentation showing more deeply pigmented macular areas and follicular points. The skin is a little atrophic. There is a reticulate arrangement of confluent lichenoid papules, suggesting lichen planus, on the chest and back.

Spiny follicular papules on the trunk and shoulders can be readily felt.

On the scalp are irregular, pink, bold, slightly atrophic patches resembling

pseudo-pelade. The mucus membrane of the left cheek is covered by a network of leucoplakia.

The Wassermann and Kahn reactions are now negative.

Section of the atrophic area shows a diffuse atrophy of the epidermis to three or four layers of prickle cells with small localized areas of acanthosis. The granular layer is well marked. Some hyperkeratosis is present, particularly in the openings of the follicles. The basal layer has lost definition and the rete pegs have largely disappeared. One area of spongiosis is present in the prickle-cell layer with vesicle formation. In the dermis are numerous large pigment-bearing cells, with œdema and dilatation of the capillaries and lymphatics.

Around the upper part of the follicle involving the basal layer of the epidermis is a localized infiltration of lymphocytes. Around the vessels in the corium a dense infiltration mainly leucocytic. Section of a papule shows a well-marked granular layer and slight hyperkeratosis. In the dermis there is a dense lymphocytic infiltrate, sharply limited below, in an œdematous stroma.

Differential diagnosis: (1) A pigmentary syphilide, (2) pigmentary lichen planus, or (3) the end-stage of a dermatitis due to the arsenic and bismuth.

Several members of this Section have mentioned the occurrence of lichenoid eruptions suggesting lichen planus after the administration of organic arsenic preparations, with subsequent atrophy of the skin.

In this case the appearance of the scalp and of the mucous membrane of the mouth, and the annular lichenoid eruption favour a diagnosis of lichen planus, which may be associated with diffuse and early pigmentation. However, the histology of the atrophic area is rather that of a dermatitis due to heavy metals than of an atrophic lichen planus.

The possibility of the histological picture of lichen planus being altered by the presence of arsenic or bismuth in the skin might be considered.

Acute Generalized Lichen Planus Obtusus following Neosalvarsan and Bisoxyl Injections.—H. W. ALLEN, B.M., B.Ch. (introduced by Dr. G. B. DOWLING).

A. W. M., male, aged 25. *History.*—August 10, 1932. There was probably both chancroidal and early spirochætal penile infection with a septic ulcer on the right thigh.

Wassermann reaction negative.

On August 10 and 19, and on September 2, 1932, neosalvarsan (Novostab) in doses of 0·45, 0·45 and 0·6 grm. was given together with bisoxyl in three doses of 4 c.c. Also eusol dressings were applied.

September 19, 1932, Wassermann and Kahn reactions negative.

The penile sores healed, and the ulcer on the thigh rapidly improved. However, after the first and subsequent injections the patient noticed dryness and irritation of the skin of the legs. Treatment was continued during November and December with weekly injections of bisoxyl, and the dry cracking condition of the skin of the legs gave place to what was diagnosed as a dermatitis, which spread rapidly to face arms, chest, abdomen and hands. The eyes tended to close up, and the patient was admitted to the ward, January 7, 1933. At this time there was weeping of the skin where the patient scratched it and some exfoliation of the legs. The mouth was not examined.

During the patient's first month in the ward, septic ulcers and abscesses from which *Staphylococcus aureus* was cultured, appeared on the legs, and this pyodermia was accompanied for days at a time, by slight pyrexia (99°-101° F.).

He was seen on March 15 by Dr. Dowling, who considered that the condition was lichen planus obtusus.

Present condition.—There are now lesions of the bucoal mucosa, scalp, palms and soles, but the nails show no evidence of lichen planus. They are worn by scratching. These lesions are papular and scaly, varying in size from that of a pin's head to that of a thumb nail, and most numerous on the lower abdomen and thighs. They are mostly violaceous, but lack a burnished surface.

March 15, 1933.—Leucocyte count, 15,000 (eosinophils, 13%).

The case seems to be one of true lichen planus, consequent upon metallic injections, acute, with lesions of the obtusus type.

Discussion.—Dr. H. W. BARBER said he supposed that the point at issue was whether the eruption in these last three cases was true lichen planus, or whether it should be called a "lichenoid eruption" resulting from metallic intoxication. He did not doubt that it was true lichen planus, and one must admit that lichen planus, like herpes simplex, and occasionally herpes zoster, was sometimes provoked by injection of these metals. He remembered a case, that of vitiligo, in which there was a suspicious history of hereditary syphilis. Though the Wassermann reaction was negative, he gave injections of novarsenobillon, and after about the fourth injection the patient complained that during the previous week he had had a pain round the trunk, and had developed an acute eruption. He (the speaker) had expected to find herpes zoster, but the eruption was a typical lichen planus, with an exact zosteriform distribution. Dr. Darier had had a similar case in a woman in whom the outbreak of the eruption was accompanied by severe pain. Such cases, he (Dr. Barber) thought, supported the view that lichen planus, like herpes zoster and herpes simplex, was due to a specific infection, probably by a neurotropic virus.

Sir ERNEST GRAHAM-LITTLE said that at the present time he had a case at St. Mary's Hospital exactly similar to Dr. Cambell's case. There was a seborrhœiform eruption of the axillæ and the other flexures, following upon a short series of injections of novarsenobillon; the patient also had a typical right orbital herpes zoster at the same time as the eruption.

Dr. Forman's case reminded him of a very similar instance which had puzzled him a good deal, in which there had been an eruption which looked exactly like hypertrophic lichen planus, but was on the face—a very unusual position. It had come on after a course of bismuth. The man had had a year of arsenobenzol, and then a year of bismuth injections. The pigmentation and the warty lichenoid patches had not come on during the arsenical treatment, but only when he had bismuth. A curious development of lichenoid eruptions, not always lichen planus, after arsenical injections, he had met with before. Some years ago he had had a remarkable case of what seemed to be typical pityriasis rubra pilaris, and regarded as such by the late Dr. Pringle, then President of the Section, but it had come on in the course of arsenical treatment extending for some weeks, administered for dermatitis herpetiformis.

Dr. DOUGLAS HEATH said that he had long thought that lichenoid eruptions similar to lichen planus were not uncommon in persons who had been undergoing treatment with arsenic for a considerable time. For example, cases of psoriasis which had been treated a long time might, a year or two later, show an eruption of lichen planus. Taking histories of lichen planus cases one was struck by the number who had previously received arsenic and possibly bismuth too. If such drugs helped to bring out lichen planus, as he thought they did, it seemed necessary to review the whole question of the treatment of lichen planus. Most dermatologists treated it with arsenic, but he gave perchloride of mercury instead, and the results had satisfied him. Cranston Low, in Edinburgh, gave antimony for acute lichen planus, perchloride of mercury for cases of moderate severity, and used arsenic only for the more chronic type. He (the speaker) would like to hear how some of the experts present treated lichen planus. In very acute cases of lichen planus he preferred heavy doses of quinine, reverting to perchloride of mercury at a later stage. How did the President treat his lichen planus cases?

Dr. NORMAN BURGESS said he would like to hear views as to the part played by bismuth in the production of these dermatoses. For two years he had been treating lichen planus with bismuth, and his results were very satisfactory.

Dr. G. B. DOWLING said that in Dr. Forman's and in Dr. Allen's cases small amounts of arsenic had sufficed to bring out the dermatitis. In Dr. Allen's case the eruption had

appeared within a few days of the first injection of neo-salvarsan, and at that time no bismuth had been given. He (the speaker) had not previously seen buccal lesions in post-salvarsan eruptions of lichenoid character.

The PRESIDENT said he did not suppose that any member would question the nature of Dr. Forman's case; he himself was satisfied about it from the skin lesions alone, and the lesions in the mouth seemed to confirm the view that it was one of true lichen planus. About the other two cases one could not be so certain. He had seen cases of this type in which the condition had begun in an indefinite way, much as in the cases of Dr. Cambell and Dr. Allen, and had later developed as more or less definite lichen planus. These cases were not particularly rare, and he thought that bismuth played an important part in their causation. He had seen this type of eruption develop in patients who had not had arsenic for about a year, but had been having bismuth during an intervening period. This did not exclude the idea of arsenic being a factor. He had not seen a case of the kind which had been on bismuth alone.

He agreed with the view that all three were cases of lichen planus type, which seemed to be associated with anti-syphilitic treatment. He had not seen eruptions of this kind follow treatment by arsenic, given by the mouth, for psoriasis and lichen planus; cases of the kind might have been recorded, but he did not remember any.

He would not call the case shown by Dr. Allen one of lichen obtusus; it did not quite give the picture usually associated with the disease. The condition here was acute hypertrophic lichen planus.

There were two distinct types of case to which the term "lichen obtusus" had been applied; one which was known under the synonym "prurigo nodularis," a well-defined condition, which was probably not lichen planus, but a form of lichenification; and the other a certain type of lichen planus on the extremities, in which the lesions were large and dome-shaped. He thought that the term "lichen obtusus corneus" was applied to the prurigo nodularis type, and the other had been called by Unna "lichen obtusus."

He (the speaker) never gave arsenic in cases of acute lichen planus—or in any form of lichen planus when the lesions were appearing; he gave perchloride of mercury. He still, however, gave arsenic fairly frequently and fairly freely in cases of chronic lichen planus, but he had never yet satisfied himself that patients who recovered from that disease did so because of his treatment. He did feel, however, that he was not any nearer a specific treatment for lichen planus than in former days. Perhaps Dr. Heath's remarks pointed towards some such specific treatment.

Dr. CAMBELL (in reply) said that the question had been raised whether bismuth produced dermatitis. With the exception of the case to which he already referred—in which the patient had received bismarsen, a drug containing arsenic and bismuth in combination—he had never seen dermatitis which could be attributed to bismuth alone, that was to say in patients who had not been treated with arsenobenzol.

"Pustular Psoriasis."—W. KNOWSLEY SIBLEY, M.D.

I have seen this patient only once, and she was so greatly distressed that it was impossible to examine her properly. She is aged 67, and says she has never had any skin trouble, nor any illness previously. Four years ago the condition began on the left great toe, and from her description it might have been gout. There has ensued a spreading of rash over the soles of the feet, the knees, the front of the legs, and the hands. All the nails are soft, and some of them have been shed. There is a typical psoriasiform rash on legs, forearms and arms, but very little about her body or scalp.

At a recent meeting here there was a long discussion on so-called "pustular psoriasis," and I am showing this case as it *is* psoriasis and it *is* pustular, but I do not know whether there is a pustular psoriasis as a separate entity. The cases which Dr. Barber introduced were acrodermatitis perstans of the palms, without any definite psoriasis on the body. This woman has obvious and extensive psoriasis, with severe pustulation: there are blebs on the soles of the feet, the front

of the knees, and the hands. It can be described, I think, as severe psoriasis which has a secondary staphylococcal pustular infection. She can scarcely walk, and her hands are very painful.

Discussion.—Dr. J. T. INGRAM said that it was difficult to place a case of this type without having investigated it. He regarded the lesion as a primary staphylococcic infection of the skin, of the type which Dr. Barber had described in 1926. In its severe form, pustular psoriasis might closely simulate the condition in this case: but a psoriasiform type of infective dermatitis might arise from a primary staphylococcal infection.

He thought that the type of benign pustular psoriasis of the palms and soles, so-called "acrodermatitis perstans," was more common than was generally supposed. Often there were associated lesions between the toes, and the latter were common without the acrodermatitis type on the soles. Perhaps this kind was not often reported because the lesions were not looked for.

These cases were frequently very resistant to treatment, but many of them responded. In his (the speaker's) original paper he described a case which had been seen by Dr. Sequeira twenty years previously, and had been cured and remained so for ten years. When seen by him (the speaker) after the relapse, it proved very resistant to treatment. A second case to which he referred in his paper was not cured then, but the condition cleared up within eight or nine months, and, so far, there had been no relapse. These were not hopeless cases.

Dr. W. N. GOLDSMITH said that one way of looking at the condition—which had not so far been mentioned—was that it was a psoriasis provoked by staphylococcal infection. He had seen boils occurring on the hands in psoriatic subjects, which gave rise to psoriasis spreading peripherally from the boil. One knew that psoriasis could also be provoked by trauma, and that it could arise for the first time at any age: he had seen a first attack at the age of 90 years. Some of these lesions were so psoriasiform that one could sympathize with Dr. Sibley in taking the view that this case was one of psoriasis. Possibly Dr. Ingram would have said that his (the speaker's) own case was simply one of a psoriasiform reaction to staphylococcic infection. He (the speaker), however, thought it was almost impossible to say that it was not one of psoriasis.

Dr. INGRAM said that there were two types: in one a staphylococcus culture could be obtained, but the other was sterile. In the present case he would expect to find staphylococci.

? Sclerodermia: Case for Diagnosis.—C. H. WHITTLE, M.D.

Miss L. H., aged 50.

History.—White plaques first appeared at the root of the neck on the right side six months ago, and these increased in number, extending upwards. Recently similar plaques have appeared on the opposite side.

Present condition.—The plaques are bluish-white, firm, sharply circumscribed, circular or oval discs in the skin. They do not exceed eight millimetres in diameter. There is some tendency to confluence. The epidermis is thin and wrinkled over them. There is a narrow lilac zone surrounding each. The area affected on either side is that supplied by the third and fourth cervical nerves through the cervical plexus. There has been little change of sensation in the part except slight burning occasionally. There are no enlarged glands to be felt, either in the neighbourhood or elsewhere, and the spleen is not palpably enlarged. There are no lesions in the mouth.

The patient is otherwise well. The catamenia ceased two years ago. There is an obvious tendency to hirsuties of the face. Kahn reaction, negative.

Diagnosis: Probably a form of sclerodermia.

Treatment: Mercury and thyroid by the mouth.

POSTSCRIPT.—Within the last three days a new crop of lesions has occurred over the spine between the scapulæ. Their eruption has been accompanied by irritation.—C. H. W.

Lupus Erythematosus with Sarcoid Tumours.—Sir ERNEST GRAHAM-LITTLE, M.D.

This patient is a woman with an extensive and typical lupus erythematosus of the scalp, resulting in cicatricial alopecia. There are also patches of active lupus erythematosus with typical follicular dilatations. The unique feature, in my experience, is the series of remarkable areas of infiltration on the right eyebrow, cheek or face, and—particularly—the neck below the chin. All along the chin margin there are deep, very vivid red indurated patches; also there are infiltrations less red, but of the same type, on the right arm. I thought it was a case of lupus erythematosus in association with sarcoid; the lesions are of the Darier type. Darier describes two varieties, and I think both are present in this patient. There is the hyperdermic induration, in which the skin moves over the nodule; and there is the variety in which the subcutaneous infiltration is definitely attached to the skin, and it forms a mass continuous with the skin, sharply demarcated from normal tissue. I have never seen sarcoid in association with lupus erythematosus. The section is interesting; to my surprise it shows no tuberculoid structure; Darier's description of his own type stresses the tuberculoid structure of the induration.

The PRESIDENT said that there were several points of extreme interest in this case. He thought that, as Sir Ernest had said, the scalp lesions were typical lupus erythematosus. If one had seen only the lesions under the left jaw, one would have regarded it as the infiltrative type of lupus erythematosus. Though one could conceive that the other lesions were a more massive type of this infiltration, he had not seen anything like it. But, even then, it was difficult to imagine lesions like those on the forearm were lupus erythematosus in the strict sense of the word. Were they examples of the Darier-Roussy sarcoid? He did not agree with the exhibitor that they were the nodular sarcoid of Darier, as the latter was probably a form of Bazin's disease. Volk, in his article in Jadassohn's handbook, put Darier's nodular sarcoid into that group, and with that the speaker thought Darier himself now agreed. He did not think it was agreed that the Darier-Roussy sarcoid was uberculous.

Drug Eruption.—Sir ERNEST GRAHAM-LITTLE, M.D.

Patient, female, aged 45. This case is one of an eruption following, if not due to, injection of solganol; there were four injections at weekly intervals. Dr. Dowling saw the case previously, and his diagnosis was lupus erythematosus. At that time there were two large areas of infiltration on the cheek. The effect of the injections was remarkable. After the first injection an extensive eruption of the erythema circinatum type occurred on the upper part of the body, the remains of it, with the gyrate margins so characteristic of erythema circinatum, can still be seen on the arms. With each succeeding injection the condition grew worse, and when I saw the patient, a month after the treatment had begun, she was very ill. An eruption of this type was over nearly the whole of her body, but on the legs there was an extensive purpura. I took her into hospital and kept her on simple expectant treatment. The eruption has almost disappeared, except for the purpura; she has recovered her health, and she is now convalescent.

This is the first time I have seen an eruption following the use of solganol; I do not doubt it was the cause of the eruption.

Discussion.—Dr. SYDNEY THOMSON said that five years ago he had seen a case of very severe lupus erythematosus in which purpura appeared following treatment with "aurophos." After the tenth injection the patient had generalized large sheets of purpura and was very ill. The purpura had begun as a follicular eruption, and the patient was taken into hospital, where physicians, pathologist and biochemist investigated the case, but nobody found anything in particular: the thrombocyte count was normal. She recovered, and gold was not used again for twelve months, bismuth being used in the meantime. Then she was put on to

"aurophos" again, when the same serious condition as before appeared after the third injection.

Dr. PARKES WEBER said that the purpura was a very interesting feature of the eruption, and one must conclude that the solganol had gravely damaged at least the cutaneous capillary blood-vessels of the legs. It was becoming more generally recognized that purpura was sometimes due to the use of various drugs. Some of the recently reported cases of purpura annularis Majocchi seemed to be due to the use of abasin or adalin—cf. the remarkable example in a doctor, aged 58 years, recently reported by Professor Morawitz, *Sammlung von Vergiftungsfällen*, Berlin, 1931, volume 2, p. 71.

Dr. ALLEN said he had given solganol for late syphilis, as advised by Professor Heuck, but had not found it of any value. On one occasion a toxic erythrodermia occurred. He had heard of an unpublished case of fatal purpura hæmorrhagica following the use of sanocrysin in tuberculosis, and another similar case associated with dermatitis and nephritis was to be found in the German literature.

In the cases of arsenobenzene purpura, reported from St. Thomas's Hospital, a granulocytopenia was found to be more characteristic than a thrombocytopenia.

The PRESIDENT pointed out that purpuric drug eruptions had been known for a long time. Such cases were now, he thought, more frequent since the introduction of the barbituric group of drugs. There was a considerable distinction between the annular purpura, which was fairly common, and Majocchi's purpura annularis telangiectodes, a very chronic condition associated with telangiectasis as well as with purpura.

Folliculitis Sycosiformis Atrophicans Capillitii.[1]—GODFREY BAMBER, M.D.

E. C., male, aged 28, for 10 years has had a slowly spreading affection on the nape of the neck. History of onset is indefinite.

Present condition.—A thickened and irregularly scarred area involves the margin of the scalp on the neck and extends upwards in the shape of a semicircle. Bounding the bare area is an erythematous zone studded with translucent looking perifollicular papules, almost as large as lentils. Central hairs are absent from some of the papules which are, in places, covered with crusts. There is no obvious follicular suppuration. The hairs in the affected area are firmly attached and when extracted show no swelling of the root. The hair bulb appears to be somewhat atrophied. There is also a small atrophic hairless patch on the crown.

Culture of hairs taken from the papules gave a growth of *Staphylococcus pyogenes aureus*.

Biopsy: The section shows an increase in the width and depth of the epithelial plugs. Dermis: An inflammatory reaction showing an increase of fibrous tissue with an abundant infiltration of plasma cells, most evident around and in the hair follicle.

[1] The title of this case has been changed from that given at the Meeting, to conform with the classification given by Erich Hoffmann (*Arch f. Derm. u. Syph.*, 1931, clxiv, 317).

Section for the Study of Disease in Children.

President—LEONARD G. PARSONS, M.D.

[*February* 24, 1933.]

Massive Necrosis of Clavicle.—R. A. RAMSAY, M.Ch.

E. B., female, aged 9 years. On 13.10.32 an abscess over the outer end of the left clavicle was incised. Skiagrams showed slight periostitis of the clavicle.

On October 31, as the wound showed no signs of closing, and as bare bone could be felt, the incision was enlarged, exposing a cavity extending the whole length of the clavicle. The walls of the cavity were the periosteum in which could be felt delicate flakes of involucrum. A sequestrum consisting of the entire clavicle except the epiphysis was lying loose in the cavity and was removed.

The cavity filled in rapidly by granulation and a new clavicle of abnormal shape has appeared.

On 9.1.33 the patient developed a purpuric rash of wide distribution, without fever. This disappeared in a week without constitutional symptoms.

New Growth on Face.—R. A. RAMSAY, M.Ch.

T. A., female, aged 4 months. First seen on 10.11.32 on account of a swelling of the right side of the face which had been noticed for two months.

The swelling lay over the right parotid gland; it was painless, soft, diffuse and ill-defined. It was opaque to transillumination and the skin was slightly bluish over it. It extended up in front of the ear and below the jaw, and was said to have been increasing in size.

On November 14 the swelling was explored and found to be very diffuse, with no definite limits, extending into the parotid and behind the jaw. It was extremely vascular and was judged to be irremovable.

A piece was removed for section and varying reports have been received.

After operation the swelling appeared to decrease in size but now it seems to be growing again.

Mr. H. J. SEDDON: Although the child has not been able to attend, it seems reasonable from such information as we have, to hazard a diagnosis of hæmangioma of the parotid. The notes tell us that the skin over the tumour was slightly bluish and that at operation the swelling was found to be extremely vascular. The section shown is of a tumour containing numerous large spaces lined by flat endothelium, and these spaces are filled with blood. The stroma has no appearance of malignancy and there is no interstitial hæmorrhage. These facts taken together justify the diagnosis.

With regard to treatment, I can only suggest that the tumour should be dealt with in the same way as an extensive hæmangioma of the cheek in a patient under the care of Mr. Douglas Harmer, when I was his house surgeon. Radium needles were implanted in the tumour through the buccal mucosa, and the immediate result was a rapid shrinkage of the tumour. If implantation through the skin were attempted, with avoidance, if possible, of the facial nerve, a similar happy result might be obtained.

Erythrœdema.—E. C. WARNER, M.D. (shown by Dr. T. J. O'REILLY).

A male child, aged 19 months, weight 17 lbs.

Normal and healthy child until 11 months old, when he had an attack of pyrexia and drowsiness lasting nine days, and he has never been normal since.

The complaint is of muscular weakness and irritability. He is able to stand if allowed to hold on to his cot, but cannot stand unaided, and cannot walk. The muscles are generally wasted and flabby. The hands are swollen and of a bluish-red colour, the changes being most marked peripherally. The feet show the same changes

to a lesser degree. The nose and cheeks are reddened, slightly scaly and cracked. The child is very irritable, lying curled up in bed all day with his face buried in the pillow.

Reflexes all present. Pain sensation diminished in limbs over affected areas. Urine and fæces normal. Blood-count normal. Pulse-rate 130.

POSTSCRIPT.—The child was treated with 3 oz. of liver daily, very lightly cooked and made into a mash. The first change was in the pulse-rate, which averaged 105 in two weeks. Since then the irritability has decreased, and in two months the hands and face have become of almost normal colour except when very cold. The muscular power has improved but progress has been slow in this respect. After eight weeks' treatment the child gained 3 lb. in weight. [E. C. W.]

Hepatomegaly of Unknown Origin (probably von Gierke's Disease).—E. C. WARNER, M.D. (shown by Dr. T. J. O'REILLY).

Patient, girl, aged 5 years. Only complaint is enlargement of abdomen.

Family history.—Patient is one of four children, two of whom are normal and

A.—Upper margin of liver. *B.*—Costal margin. *C.*—Lower margin of liver.

healthy; a third died aged 5 months, with persistent vomiting, and the abdomen was thought to be enlarged. There was no consanguinity between the parents.

When 2 years old, following bronchitis, patient had obstructive jaundice lasting seven days, with pale stools and dark urine. After this the abdomen was noted to be

enlarged and has remained so and when examined immediately afterwards the liver reached ½ in. below the umbilicus. At the age of 3½ the liver reached 2 in. below the umbilical level. She was subject to repeated attacks of bronchitis, and short recurrent attacks of vomiting.

Present condition.—A well-nourished healthy-looking child whose height is only 33½ in. The liver is very large as outlined in the illustration. The surface is smooth, not tender, and the enlargement regular. No spleen can be felt.

The Wassermann reaction is negative, as is that of both the parents. The urine and fæces are normal. Van den Bergh, lævulose tolerance test and blood-count are normal.

Dr. F. PARKES WEBER said that, considering the absence of splenomegaly and the complete absence of signs and symptoms, excepting the hepatomegaly itself and slight dwarfism in growth, one was forced to consider the possibility of the case being one of von Gierke's type of hepatomegaly due to accumulation of glycogen in the glandular cells of the liver. Von Gierke in a later article (*Med. Klinik.*, 1931, xxvii, pp. 576, 611), said he thought that the diagnosis during life could be made certain only by "biopsy" examination of the liver (hepatic puncture and microscopic examination), but L. Schall (*Münch. Med. Woch.*, 1932, lxxix, p. 2078), was not quite of the same opinion. In the present case it would be interesting to know whether the blood-sugar was always below the normal and if on repeated examinations the urine were sometimes found to contain acetone and diacetic acid. He, Dr. Weber, had not heard of jaundice in association with von Gierke's hepatomegaly.

POSTSCRIPT.—The great tendency to ketosis and hypoglycæmia in these cases was remarked on by Dr. Parkes Weber. This patient showed neither when on a full diet, but when he was starved the blood-sugar fell to ·048 at twelve hours, and acetone appeared in the urine. The amount of acetone was actually increased 2½ hours after giving 20 grams of glucose by mouth. After giving 4 minims of adrenaline subcutaneously the blood-sugar rose only ·002% as a maximum at the end of five minutes, as compared with a control of the same age in whom the rise was ·031%. [E. C. W.]

Hydrocephalus Successfully Treated by Repeated Puncture of the Lateral Ventricles.—E. C. WARNER, M.D. (shown by Dr. T. J. O'REILLY).

D. B., male, aged 3 years and 7 months.

Two other children in family, both normal and healthy.

First seen when aged 6 months; had then headache, screaming and vomiting. A precocious child, with no physical signs of disease except general enlargement of the head (circumference 19¼ in.) with distended veins, and an extensive nævus of the face.

Puncture of the lateral ventricles was performed, and 30 c.c. and 20 c.c. of clear fluid was removed on the first and second occasions respectively. This made no difference to the steady growth in size of the head, and the screaming attacks continued. On the third occasion the ventricle was completely drained of 90 c.c. of clear fluid: the head actually became smaller for a time. The symptoms ceased, and the child has not complained since.

The head enlargement is now proportionate to the rest of the body. The metopic suture is still open and gives exit to large veins. The child is mentally advanced for his age.

A recent skiagram of skull shows nothing suggestive of meningeal hæmangioma.

The value of removing as much cerebrospinal fluid as possible in a case such as this is probably due to breaking a vicious circle, and allowing emptying of the vein of Galen, so relieving the congestion of the choroid plexuses. It appears well worth trying in any case of hydrocephalus of idiopathic origin in a baby.

Dr. PARKES WEBER suggested that in the present case an extensive hæmangiectatic meningeal nævus might be associated with the extensive hæmangiectatic cutaneous nævus; it might possibly in some way be causally connected with the hydrocephalus, though he (Dr. Weber) had not heard of any such association having been observed.

Recurring Collapse of Lung with Enlarged Mediastinal Glands. ? Epituberculosis.—T. PEARSE WILLIAMS, M.D.

T. S., male, aged 42 weeks, an unwanted infant, admitted to the Willesden General Hospital in November, 1932, from an adoption home. History of obstinate cough and two mild attacks of bronchitis.

A well-nourished infant suffering from mild bronchitis, and noticed to become cyanosed when enraged.

Over the mesial half of the right upper and middle lobes anteriorly and the apex of the lower lobe posteriorly the percussion note was impaired and the air entry diminished, with high-pitched expiration; there were a few scattered sibili.

Wassermann negative; Mantoux negative at 1 : 5000.

Blood-count: R.B.C. 5,000,000; Hb. 54%; W.B.C. 11,000; polys. 16%; lymphos. 77%.

Radiological report (Dr. Rohan Williams).—"Great increase of upper mediastinal shadow especially to the right. There is apparently no cardiac or tracheal displacement. Peripheral lung fields apparently clear. The outer border of the mediastinal shadow is sharp and clear, and would not suggest mediastinal adenitis only. I would temporarily suggest an epituberculous collapse due to mediastinal glandular enlargement, but nature not really obvious."

Gastric lavages examined for tubercle bacilli were negative.

Three weeks later a further skiagram revealed no change.

5.12.32.—The temperature, which previously had been normal, rose to 103° F., and definite signs of consolidation appeared over the upper and middle lobes of the right side. Inhalations of oxygen and carbon dioxide were given daily, and the temperature became normal on 12.12.32. There has been no fever since.

Radiological report.—20.12.32. "Right root shadows slightly in excess of average but there is an enormous improvement—in fact disappearance of the right mediastinal shadow previously noted. This lends support to the view that this was an area of pulmonary collapse which has now, however, re-aerated."

The infant has steadily progressed in weight and behaves normally and happily. However, the physical signs in the right upper lobe have gradually returned and a further X-ray examination, 9.2.33, led to the following report:

"The right paramediastinal shadowing has returned and presents the same appearances seen at previous examinations."

16.2.33. Blood-count: W.B.C. 8,600; polys. 31%; lymphos. 67%.

Congenital Lipoma.—DAVID LEVI, M.S.

The patient, a male child, was born on 20.2.28 with a mass on his back the size of an orange below and between the scapulæ and also a smaller mass below and to the left of the larger one.

On 14.12.28 the child was first seen at the Infants Hospital; the mother stated that the tumour was growing rapidly, being at this time twice as large as when the child was born.

The patient was kept under observation and by 27.10.29 the mass was three times its size at birth. I saw him for the first time in November 1929 and diagnosed a subcutaneous lipoma of the back. At operation on 15.11.29 the tumour was found to consist of a mass of fat which was infiltrating the muscles of the back. Some of the lobules of fat were traced through the posterior abdominal wall to the peri-renal tissue. In other places the fat became continuous with the muscle fibres. Complete removal was found to be impossible. The patient was kept under observation and the residual tumour was measured; it gradually increased in size. On 10.4.31 a small mass appeared behind the anus. On 16.10.31 eight ounces of growth were removed from the site of the original tumour. Operation was again performed on 20.5.32 and a large mass of fat was excised from the same area.

Report on section sent to pathological department for examination: "Tumour consists of fat."

[*March* 24, 1933.]

Concomitant Squint in Children and Modern Methods of Treatment.

By G. G. PENMAN, F.R.C.S.

SQUINT is a non-physiological divergence of the optic axes from the parallel. There are two kinds: paralytic and concomitant.

Paralytic squint is due to defective action of one or more of the extrinsic ocular muscles, either from local damage or disease of the muscles, or the nerves supplying them—or from lesions in the brain.

A concomitant squint is a muscle-balance defect, and there is usually no actual paralysis of any muscle: though occasionally there is a slight paresis of a muscle in addition. The angle between the optic axes is the same whichever way the eyes are turned, and diplopia is rarely present: and if it is, is not marked.

There is also a latent type of concomitant squint, known as heterophoria, in which the visual axes are normally parallel, held so by an effort, the binocular vision being sufficiently good to make this effort essential to prevent diplopia. When, however, the images presented to the two eyes are dissimilar—or when the patient is tired or ill, a slight squint can often be demonstrated.

It is with concomitant squint that I propose to deal in this paper.

This may be convergent or divergent, rarely vertical. The great majority of squints in children are of the concomitant convergent type.

The squinting eye in concomitant convergent squint tends to lose its vision secondarily from suppression of the image received on its retina—though in some few cases the amblyopia is primary.

In concomitant divergent squint, the squinting eye usually has bad vision to start with, either from myopia or some other defect.

ÆTIOLOGY OF CONCOMITANT CONVERGENT SQUINT.

There are two main factors: (1) Cerebral lack of fusion power. If tested with the amblyoscope or synoptophore, the ability to obtain stereoscopic vision, or even to fuse two simple pictures is lacking—though in many cases it is latent, and can be brought out by exercising it. (2) Hypermetropia. Practically every case is hypermetropic, sometimes to a very high degree, and sometimes the hypometropia is combined with astigmatism.

Hypermetropes can see clearly at a distance only by using their accommodation, and convergence centres are close together and intimately connected, so that the constant accommodative effort makes them tend to converge.

If the fusion sense is good, any deviation of the visual axes from the parallel will result in diplopia, but if it is poor there is little or no diplopia, and the child's eye settles into a squint.

If there is slight diplopia, the image from the squinting eye is suppressed and the sight of that eye deteriorates, though there is no defect in the eye itself.

In alternating squint, where the patient uses one eye or the other indifferently, the fusion sense is almost absent, but on the other hand, as both eyes are equally exercised, the sight is good.

Concomitant convergent squint usually comes on after the age when binocular vision is fully developed (eighteen months) and generally after some shock or illness. Occasionally, however, it occurs earlier, or the child is even "born with a squint." These early cases are usually very marked, and of the alternating type. Squint frequently runs in families, or perhaps one should say that the two causative factors do so.

TREATMENT.

There are three things to be dealt with in these cases :—

(*a*) The squint, which is the only thing that worries the patient.

(*b*) The defective vision in the squinting eye—the most important thing, so often neglected, and the cause of many blind and semi-blind eyes.

(*c*) The defective fusion sense.

The first essential is for an accurate retinoscopy to be performed, and glasses to be provided if necessary, which they nearly always are. The majority of squints come straight with this alone. If the child can read, and the vision of the squinting eye is defective—or if it cannot read, and there is any tendency to use one eye more than the other, the sound eye must be put out of action in some way, to exercise the bad eye.

This is most important—so often parents are told that a child will "grow out of" a slight squint, with the result that it grows up with a very defective eye. It is essential to make sure of the sight in the squinting eye early. If it is left until after seven years of age, it is too late—and there is little hope of improvement in vision. The earlier this occlusion is started, the more effective it is likely to be.

The mildest form of occlusion is to keep the good eye atropized : in some cases this suffices, and the patient takes up fixation with the squinting eye. If this does not happen, the good eye must be kept covered with a shade (preferably the Doyne shield) for periods varying from two hours a day to six days a week, depending on the state of the sight in the bad eye, and the rate at which it improves. In children unable to read, much information can be gained from the readiness and steadiness with which the bad eye fixes.

If the child sees well with both eyes, or when the bad eye has been trained up to a fair degree of vision, ($\frac{6}{18}$ or better is the standard usually adopted) fusion training may be commenced at once, if the child is over four, or unusually intelligent, otherwise, as soon as the child seems capable of deriving benefit by these measures.

Fusion training, or orthoptic treatment, as it is now called, is the systematic education of binocular, and finally stereoscopic vision : and restoring to the parallel of the visual axes by means of exercises with various instruments, all on the principle of the stereoscope.

There is nothing new in the principle of this treatment—which Worth used with his amblyoscope—but it is not always successful unless other measures are also used.

It is, however, an extremely useful adjunct to these other measures, and frequently converts a partial cure into a complete one.

The two chief instruments used are the synoptophore—which is merely a giant Worth amblyoscope, electrically lighted, and with fine adjustments—and the cheiroscope, in which the child can develop hand and eye together.

Binocular vision may be said to have four grades :—

(1) Simultaneous perception : (of two objects one within the other). (2) Simultaneous macular perception : (of two objects superimposed). (3) Fusion. (4) Stereoscopic vision.

A very interesting phenomenon was early recognized, and has been successively called "false macula," "false projection," and now "lack of retinal correspondence." It occurs usually in children with slight degrees of squint : in these cases it is sometimes found that although they are still squinting 10 to 15 degrees, they get some binocular vision with the synoptophore set at 0. In other words, although the image of the object seen by the squinting eye is not falling on the macula, it is projected on the child's perceptive apparatus as though it were actually on the macula. This is difficult to eliminate in many cases, but it must be got rid of before the true macula can be dealt with, otherwise the fusion training working on the false macula makes the squint more persistent than before.

In bad squints, orthoptic treatment is a valuable adjunct to operation, and should be given both before and after. The actual carrying out these exercises is extremely tedious, and takes a great deal of time—and is for the most part done by trained staff who work under the direction of the ophthalmic surgeon, in the same way as the masseuse works under the direction of the orthopædic surgeon.

The first person to take up this work was Mrs. Lowndes Yates, who was given charge of the first orthoptic clinic to be opened in this country, at the Royal Westminster Ophthalmic Hospital two or three years ago, and is still doing valuable work there.

Operation.—As regards operation there are several points to consider:—

(1) The effect of glasses should be tried in all cases for at least a year, to see if these will bring the squint straight, or almost straight. If they do, operation is not required.

(2) The question of binocular vision: In a child under four years old with a very bad squint it is sometimes advisable to operate, and commence orthoptic treatment as soon as possible in order to obtain binocular vision.

(3) The psychological aspect: Some children are very sensitive about their squints, others do not seem to mind in the least.

Small boys who get much "ragged" by their schoolfellows are often worried about their squints, and in such cases, if other measures fail, and there seems to be real unhappiness, operation should be performed soon.

For the same reason it may be well to operate when the patient is changing schools, e.g., preparatory to public school.

(4) The anæsthetic: If possible it is best to wait for operation until it is feasible to use a local anæsthetic—that is until the patient is from 12 to 14 years of age. The operation is far more likely to be absolutely successful under a local than under a general anæsthetic, as in the latter case, the muscles are relaxed, and it is difficult to gauge precisely how much shortening or lengthening is required. Under local anæsthesia the muscles are working normally, and by observing the corneal reflexes the eyes may be accurately adjusted on the operating table.

(5) Very often squints which have not been quite remedied by glasses come straight between the ages of 10 and 14. One may say, then, that as a rule operation may be deferred until this age, and performed under a local anæsthetic.

The kind of operation varies greatly with the operator, but, for convergent squint, all are based on shortening of the external rectus and lengthening or division of the internal rectus, separately or combined. For divergent squint the reverse is done. Free tenotomy of the internal rectus is never done nowadays (or should not be), as eyes on which this operation has been performed tend to diverge after a time. This muscle may be partially divided after the manner of a tendo-Achillis lengthening; the central portion may be completely divided and attached to the sclera further back, or it may be stretched so as to rupture some of its fibres and paralyse it for some days.

The external rectus may be divided at its attachment to the globe and planted further forward, or a length removed and the stump stitched to the original attachment, or a reef may be taken in this muscle. In very bad squints it may not be possible to obtain sufficient effect by operating on one eye only: in these cases the second eye should be dealt with in a similar manner. Patients sometimes complain of the redness left over the site of operation. This has usually disappeared by the end of three months.

Summary.

(1) The common squint of children is a concomitant convergent squint.

(2) The two factors in this are defective fusion sense and hypermetropia.

(3) The first is dealt with by orthoptic treatment, which is described, the second by correction of the error of refraction.

(4) In addition, the squinting eye often sees badly through suppression of the image conveyed from it. This must be dealt with early by temporarily putting the good eye out of action. Parents must never be told that a child will "grow out of" a squint.

(5) If other methods fail, operation should be performed.

Lymphadenosis commencing with the clinical picture of Hypoplastic Anæmia.—F. PARKES WEBER, M.D., and W. WEISSWANGE, M.D.

G. E., aged 11 years, an English boy, was admitted to hospital on January 2, 1933, in a very anæmic condition, with the history that he had been habitually somewhat pale, but that the real illness had seemed to commence only a few days before admission with great pallor and slight epistaxis. He had continued to attend school till three days before admission. In hospital he had at first moderate variable fever (there was at that time an epidemic of influenza) and severe epistaxis, but since January 5 he has remained nearly free from both. His pallor has varied, as has the degree of anæmia (see chart). The lymphatic glands in the axillæ, groins, and neck have often been slightly (but never greatly) enlarged. A skiagram of the thorax shows slight excess of shadowing in the hilar and supra-aortic regions. The spleen and liver have never been palpable, but there has always been decided fullness of the abdomen, as if some of the viscera or lymph-glands (possibly retroperitoneal), were enlarged. Fractional examination of the gastric contents showed no achlorhydria or hypochlorhydria. The blood-serum gave negative Wassermann and Meinicke reactions, and a moderately positive indirect (negative direct) van den Bergh reaction. Examination of the urine has usually shown a trace of albumin, and lately there have been many granular tube-casts in the centrifuge-sediment. Brachial blood-pressure 105/40 mm. Hg. No cutaneous purpura or retinal hæmorrhages. The boy is now gradually losing weight, though not to any marked extent.

The treatment has been mainly by blood-transfusions and by intramuscular injections of hepatopson; the latter caused a decided blood-eosinophilia (up to 12% on February 20). On January 4 an intramuscular injection of "coagulen" (Ciba) and other measures were temporarily employed against the epistaxis.

The accompanying table shows thrombocyte-counts, the diminution in the anæmia, the temporary eosinophilia and the gradual increase in the white cells, especially the lymphocytes; the blood-transfusions are also marked on the chart, and they were obviously followed by great improvement in every way in the boy's condition.

On the whole we regard the case as one of lymphadenosis, more or less aleukæmic (subleukæmic), commencing with the clinical picture of hypoplastic anæmia. It is quite possible that there is some lymphocytic infiltration of the kidneys, giving rise to the cylindruria.

Additional note (March 27, 1933).—Since the above was written the boy has had attacks of severe epistaxis, treated by intramuscular injections of coagulen (ciba), intravenous injections of calcium chloride and blood transfusions. There has been no cutaneous purpura or retinal hæmorrhage. The Van den Bergh reaction is still indirect positive, decidedly beyond the normal. Blood-serum calcium: 12·2 mgm. per cent. Capillary resistance (Rumpel-Leede) test, positive. Fragility of the erythrocytes, bleeding time and blood-coagulation time are all normal.

Discussion.—Dr. BERNARD SCHLESINGER said that in cases of lymphadenosis which he had seen, blood transfusion had often been followed by unpleasant results. When the leucocytes were few in number in so-called "aleukæmic leukæmia," on more than one occasion he had seen blood transfusion cause rapid rise in the leucocytes, hæmorrhages, and a hastened fatal ending. In his opinion, with our present knowledge, the only justifiable treatment in cases of leukæmia in children was symptomatic treatment directed chiefly towards gentle euthanasia.

Dr. R. C. JEWESBURY said he noticed that the boy's illness had begun about three months ago, yet there was no definite enlargement of the spleen. Did Dr. Parkes Weber think that leukæmia could exist for so long a time without causing splenic enlargement?

	Jan. 2, 1933	Jan. 4	Jan. 5		Jan. 9		Jan. 14	Jan. 17	Jan. 21	Jan. 25	
Hæmoglobin %	38	31	20		31		42	54	55	55	
Erythrocytes per c.mm.	2,520,000	1,140,000	1,080,000	Blood transfusion, Jan. 5, 180 c.c.	1,300,000	Blood transfusion, Jan. 12, 280 c.c.	2,040,000	2,280,000	2,900,000	3,140,000	
Colour index	0·8	1·36	0·92	Blood transfusion, Jan. 7, 270 c.c.	1·2		1·03	1·2	1·0	0·89	
Leucocytes per c.mm.	6,000	1,150	800		700		1,600	3,300	3,800	5,100	
Basophils %	0	0	—		0		0	1	1	—	
Eosinophils %	0	0	—		0		2	1	3	—	
Myeloblasts %	0	2	—		0		0	0	0	—	
Myelocytes %	0	4	—		0		0	2	1	—	
Metamyelocytes %	1	4	—		0		0	0	0	—	
Polymorphonuclear neutrophils %	17	30	—		34		20	37	56	—	
Lymphocytes %	79	60	—		56		66	37	29	—	
Monocytes %	3	0	—		10		12	22	10	—	
Normoblasts to 100 leucocytes	2	4	—		0		0	1	0		
Megaloblasts to 100 leucocytes	1	2	—		2		0	0	0		
Thrombocytes per c.mm.	100,000	—	—						250,000		
Anisocytosis	++	++	—		++						
Poikilocytosis	+	+	—		+						
Polychromasia	+	+	—		0						

Hepatopson therapy commenced Jan. 25

	Jan. 30	Feb. 6	Feb. 13	Feb. 20	Feb. 27	March 6		March 13	March 19		March 27
Hæmoglobin %	70	70	69	80	71	69		61	40		45
Erythrocytes per c.mm.	3,320,000	3,540,000	3,600,000	4,340,000	3,820,000	3,460,000		3,420,000	2,800,000		2,220,000
Colour index	1·06	1·0	0·96	0·92	0·93	1·0		0·9	0·7		1·0
Leucocytes per c.mm.	8,100	13,030	17,150	24,500	19,100	24,150		23,800	36,100		7,900
Basophils %	0	0	0	0	2	0		0	0		0
Eosinophils %	1	1	8	12	5	6		6	2		4
Myeloblasts %	0	0	0	0	0	1		1	1		1
Myelocytes %	1	1	0	5	4	1		1	0		3
Metamyelocytes %	0	0	0	3	4	4		1	3		4
Polymorphonuclear neutrophils %	57	66	57	26	31	33		20	13		8
Lymphocytes %	32	18	27	41	42	48		68	78		80
Monocytes %	9	14	8	3	12	7		3	3		0
Reticulocytes % of red cells								0·25			0·1
Normoblasts to 100 leucocytes	0	0	0	Very few present	1	2		2	5		14
Megaloblasts to 100 leucocytes	0	0	0	0	0	2		1	5		4
Thrombocytes per c.mm.								340,000			300,000
Anisocytosis				0		+		+			+
Poikilocytosis				+		0		+			0
Polychromasia				0		+		+			+
Positive oxydase reaction % of total leucocytes								16			16

Hepatopson discontinued March 6

Blood transfusion, March 19, 270 c.c.
Blood transfusion, March 21, 280 c.c.
Blood transfusion, March 23, 280 c.c.
Hepatopson therapy recommenced on March 23

Dr. PARKES WEBER said he had seen temporary benefit from blood transfusions (the "athrombit" direct method) in a case that subsequently proved to be one of leucopenic myelosis (F. P. Weber, *Quart. Journ. Med.*, 1932, new series, i, 409). In that patient he believed that during life the spleen was not definitely palpated; after death it was nevertheless found to weigh 400 grammes.

POSTSCRIPT (April 22, 1933).—The patient died on the night of April 2 to 3 after tremendous epistaxis. The necropsy and microscopic examination proved the case to be one of lymphadenosis, with lymphocytic infiltration, especially of the kidneys, liver, testes and bone-marrow. The kidneys were greatly enlarged (800 grammes together) and pale, with purplish ecchymotic patches. The liver was enlarged, weighing 1950 grammes, and the spleen weighed 200 grammes. A piece of lung, and a hilus lymph-gland attached to it, both showed lymphocytic infiltration. [F. P. W.]

Persistent Pneumothorax after Post-Pneumonic Empyema.—F. PARKES WEBER, M.D., and W. WEISSWANGE, M.D.

K. W., a boy, now 1½ years old, had measles at 6 months of age, which was, it seems, followed by bronchopneumonia. Then the child remained well till he again had "bronchopneumonia," three weeks before admission to hospital, which was on

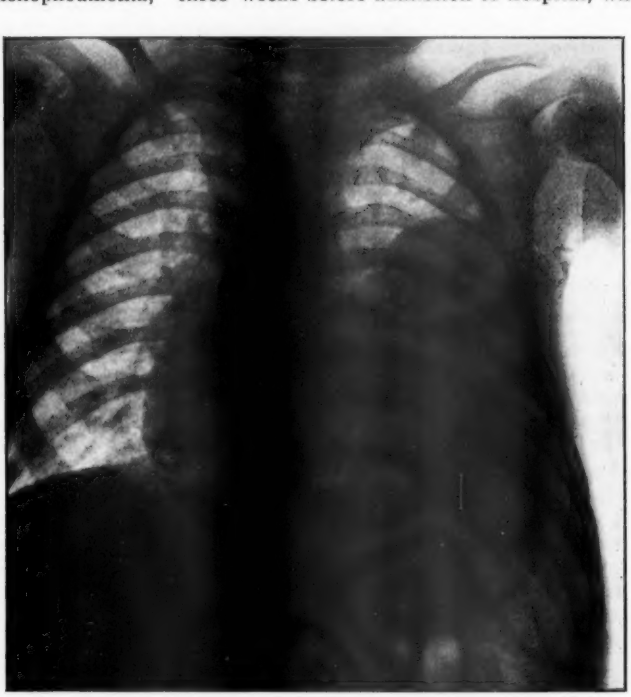

FIG. 1.—November 1, 1932.

October 22, 1932. In the hospital there was variable fever; the ribs were slightly beaded, and there was considerable anæmia, with a polymorphonuclear leucocytosis. On October 25 there were signs of fluid in the left pleura, from which a little pus

was obtained with the exploring syringe. The pus contained pneumococci and staphylococci.

It was decided to treat the empyema by aspiration, as required, but the pus was coughed up, and on November 15 the left-sided empyema was shown by X-ray examination to have given place to a pneumothorax, which has persisted since then, and is well illustrated by the skiagrams. For a long time there were signs of bronchopneumonia of both lungs with variable fever, but since February 11 there

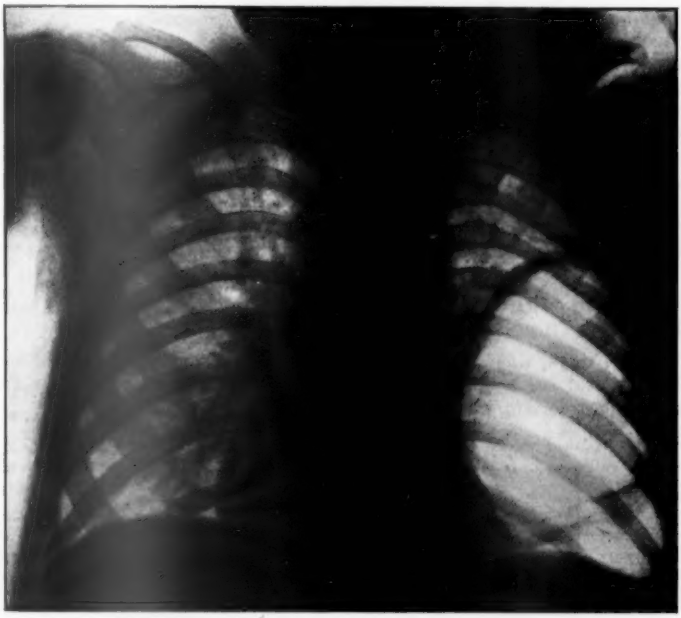

FIG. 2.—March 1, 1932.

has been hardly any fever and the bronchopneumonia has been absent. However, the left pneumothorax persists, and the heart is still considerably displaced to the right. Blood-count (March 6): Hæmoglobin, 70%; erythrocytes, 3,820,000; leucocytes, 12,000 (of which 61% are polymorphonuclear neutrophils). The patient has recently gained a little in body-weight. Pirquet cuti-reaction negative.

POSTSCRIPT (April 22, 1933).—The pneumothorax cavity has greatly diminished in size, without any special treatment.—[F. P. W.]

Colobomata of Choroid.—W. M. FELDMAN, M.D.

The patient, D. W., a female child, aged 1 year, has been having fits since one month after birth. A full-time baby, weighed 6½ lb. at birth; birth normal. Breast-fed for ten days and then fed on Nestlé's milk. She is an only child and there is no history of fits in the family.

During a fit the child's eyes are turned towards the left and fixed. The limbs become rigid, first on the left side, then on the right. There is no clonic stage. There is no foaming at the mouth and no incontinence of urine or fæces.

There is ptosis of the left upper eyelid and a left divergent strabismus.

The left fundus shows a fairly large colobomatous area on the inner side of the optic disc and is pigmented round about the edge. There are several more colobomatous areas all over the fundus. There is a large one in the right fundus going down from the optic disc; there is another small clear-cut one, about half the size of the optic disc, at the macula. There are several more such areas all over the fundus. Both optic discs appear to be normal.

There is slight weakness of the left face and of the left neck muscle. Reflexes normal.

Cerebrospinal fluid (4.11.32).—Slightly under pressure; 2 cells per c.mm., all lymphocytes. Protein 0·1%. Globulin, slight increase. Sugar normal. Chlorides 730 mgm. %. No T.B. or other organisms seen. Wassermann reaction negative.

Radiologist's report (28.10.32).—There is slight cupping of the inferior diaphysis. of the tibia. Skull within normal limits.

Blood-count (11.9.32).—R.B.C. 3,800,000 per c.mm.; Hb. 80%; W.B.C. 6,100 per c.mm. Polys. 43%; lymphos. (small) 50%, (large) 1%; eosinos. 6%.

Coagulation and bleeding time normal.

Urine normal. Urine chlorides 0·76 grm. %.

The child has continued to have fits daily, but they have lately been less frequent. The eye condition has progressed and there are now numerous colobomatous areas.

Hypertelorism with Cleft Palate.—W. R. BETT, L.R.C.P., M.R.C.S. (for Dr. H. H. CHODAK GREGORY).

G. B., aged 7 days, was admitted on 20.2.33 to the Princess Elizabeth of York Children's Hospital on account of feeding difficulty due to a cleft palate. The condition of hypertelorism was accidentally discovered.

FIG. 1.

FIG. 2.

The only abnormalities occur in the head and face (figs. 1 and 2). The face is somewhat flat, chin receding, ears pointed, nose well developed with a broad base. The eyes are widely separated, the distance between the inner canthi being 1½ in., and slanting. Fontanelle widely open. Marked bony prominences behind both ears. Cleft palate. Skiagram of skull and spine shows no abnormalities. Fundi and vision apparently normal.

Family history negative.

Cerebellar Tumour. ? Right Lobe.—REGINALD C. JEWESBURY, M.D.

P, M., a girl, aged 7 years. Admitted to hospital 27.2.33 with a history of frontal headache, which had begun one month previously. This was followed three weeks later by vomiting attacks. These symptoms have continued. The mother stated that the child dragged her left leg.

Nothing of importance in family history or past history.

Condition on admission.—Very drowsy; speech slow, but able to answer questions quite rationally; has rather a fixed stare; unable to sit up without support; cannot stand.

Ophthalmologists' report (Mr. P. G. Doyne) 2.3.33: "I should say that discs are within normal limits."

Since then there appears to be an early left papillœdema. The right disc is indefinite in outline. No nystagmus; eye movements normal; pupils equal, react to light and accommodation. Vision: Right = $\frac{6}{6}$; left = $\frac{6}{9}$. Visual fields normal. ? Slight right facial weakness. Deaf on right side.

Marked cerebellar inco-ordination with hypotonia in right arm and right leg. Tendon reflexes absent or diminished on right side. Sensation normal. Temperature subnormal. Pulse, 80-100. Respirations, 20-25.

Skiagram of skull shows nothing abnormal.

Cerebellar Tumour, ? Left Lobe.—REGINALD C. JEWESBURY, M.D.

E. P., a girl, aged 12 years. Admitted to hospital 7.3.33. She was quite well until the end of November, 1932, when she began to suffer from sudden attacks of vomiting; these attacks occurred after breakfast and were copious and projectile. A little later she complained of occasional frontal headaches extending over her right eye. These symptoms have continued up to the present time.

Patient is a healthy looking girl of normal intelligence. Slight torticollis to right. Marked squint. Intense bilateral papillœdema which appears to have developed rapidly. Vision: right, $\frac{6}{12}$; left, $\frac{6}{9}$. Visual fields full. Pupils normal.

Weakness of right sixth nerve. Nystagmus, right and left; more regular on right. Fifth nerve normal; seventh, slight weakness (left); eighth to twelfth, normal.

Hypotonia and marked cerebellar inco-ordination of left arm, and to less extent of right arm. Marked hypotonia of legs more marked on left side.

Bilateral cerebellar inco-ordination of legs, more marked on left side. All tendon reflexes depressed or absent. Abdominal reflexes present. Plantar reflexes flexor. No sensory changes.

Gait very ataxic, rather tending to go towards the left. Temperature subnormal; pulse, 80-100; respirations, 20-30.

Skiagram of skull (lateral view): "Absorption of inner table at summit of vault, with some local irregularity."

Record of Cases of Cerebellar Tumour in the Children's Department at St. Thomas's Hospital since 1921.

By REGINALD C. JEWESBURY, M.D.

(1) 1921.—V. H., girl, aged 7 years. Diagnosis, left cerebellar tumour.
Decompressed; tumour not seen; symptoms relieved by operation.
Well until 1924 when vomiting and ataxy reappeared with left hemiplegia.
1927.—Symptoms more marked. Operation: cyst tapped, sclerotic growth removed. Died thirty-six hours after operation.
Post mortem: Left cerebellar tumour (glioma).

(2) 1926.—B. B., girl, aged 5 years. Four months' history of cerebellar symptoms.
Operation: decompression. Cystic cerebellar glioma removed. After this freedom from symptoms for five years.
Re-admitted 1932. Headaches and inco-ordination of left arm. Second operation: further decompression. Nodule of neoplasm removed—cyst aspirated. Later, deep X-ray therapy. General improvement. Patient still alive.

(3) 1927.—J. F., boy, aged 6 years. Four months' history of nystagmus, headache and vomiting.
Operation: Left cerebellar tumour, decompressed and aspirated. Died a few weeks later.

(4) 1927.—E. M., girl, aged 11 years. One month's history of vomiting and frontal headache. Papillœdema + +. No localizing signs.
Operation: decompression (right temporal). Patient died after operation.
Post mortem.—Left cerebellar cystic glioma.

(5) 1928.—D. M., girl, aged 7 years. Three months' history of vomiting, headache and vertigo.
Operation: decompression; cerebellar tumour present. Died one week after operation. No post-mortem examination.

(6) 1928.—L. F., boy, aged 3½ years. Five months' history of vomiting, headaches and ataxy.
Operation: decompression. Died seventeen days after operation.
Post mortem: Mid-line cerebellar tumour.

(7) 1929.—V. B., girl, aged 3 years. Five months' history of vomiting and increasing ataxy. Papillœdema + +. Died. No operation.
Post mortem: Right cerebellar medullo-blastoma.

(8) 1930.—F. R., boy, aged 4½ years. Two months' history of headache, vomiting and ataxy. Nearly blind.

Operation: decompression and piece-meal removal, followed by application of radium.
On discharge: sight good, no physical signs.
Mid-line cerebellar glioma.
(This patient cannot be traced; he is thought to be dead.)

(9) 1931.—B. H., girl, aged 10 years. Five months' history of headache, vomiting and ataxy.

Operation: decompression and exploration; no tumour could be found at operation. Died two days after operation.

Post mortem: Right cerebellar glioma.

Out of a total of nine cases only one patient is known to be still alive. The operations in these cases were performed by the late Sir Percy Sargent.

(10) (11) 1933.—The two cases shown at this meeting.

Achondroplasia with Kyphosis.—JEAN SMITH, M.D. (for Dr. ERIC PRITCHARD).

E. C., female, aged 12 months. Was sent up to hospital at the age of 4 months, because her head was larger than normal. The family doctor had already noticed this when the child was only 4 weeks old. When first seen at hospital she presented the typical appearance of well-marked achondroplasia—large head with projecting forehead, stunted limbs and trident hands. The skiagrams also showed the characteristic features of this disease. During the fifth month an unusual feature—a kyphosis—developed in the dorso-lumbar region, and has become increasingly prominent as the child has grown older. A skiagram of the spine taken on February 10 suggests that the cause of this kyphosis may lie in the first lumbar vertebra, and possibly also the second. Although it would be an exaggeration to describe them as "wedge-shaped" as yet, they are not normal. Two similar cases were described by Wheeldon in 1920 (*Amer. Journ. Dis. Child.*, 1920, xix, 1).

Vitiligo with Grey Hair.—JEAN SMITH, M.D.

F. E., female, aged 8 years. Brought to hospital because her hair had been going grey for the past six months, during which time she had also been listless and whining, frequently complaining of pains in her legs. The abnormal pigmentation of the trunk had been noticed, but as it had appeared immediately after her summer holiday, the mother had thought it was due to excessive sun bathing.

The patient is a well-developed child of average weight for her age. Grey hairs are scattered diffusely over the scalp but are more marked in the temporal regions. The trunk, both anteriorly and posteriorly, shows well-marked areas of leucoderma. The teeth and nails are normal.

Discussion.—Dr. PARKES WEBER said that he regarded the case as a typical one of vitiligo. The history of the pigmentary disturbance in the skin being specially noted in the summer was characteristic, but the appearance of diffuse (not patches of) grey hairs in the scalp of children and young persons, resembling as it did in the present case commencing senile canities, was not sufficiently recognized as occasionally being associated with vitiligo.

Endocarditis with Emboli in a Child, with Recovery.—G. H. ROSSDALE, D.M.

G. J., female, aged 6 years, admitted to St. Mary's Hospital for Women and Children, Plaistow, April 21, 1930, and discharged July 25, 1932.

This child's illness lasted just over two years. No previous history of rheumatism. The illness commenced with pain in the foot, the left ankle-joint being red and inflamed; she had also pain in the right hand and headache. There was a systolic bruit at the apex.

There were fourteen separate periods of pyrexia, two being more prolonged and severe than the others. The first severe one commenced in January, 1931, and continued for 185 days; the second commenced in January, 1932, and continued for 119 days. The condition of the child during the attack which commenced in January, 1931, was very grave, and in the summer of that year it appeared by the wasting and general toxæmia that she must inevitably die.

Joints.—The joints affected during the course of this illness were both ankles, shoulders, hips and wrists. These joints were affected at different times by stiffness,

pain on movement, and swelling. Subsequently they all became normal, except for stiffness in the hip-joints.

Heart.—The heart was dilated; a triple rhythm was heard, and the apex beat was about 160, with marked irregularity of the rhythm.

Skin.—Erythematous nodules were present on the shins and erythematous patches appeared on the body and limbs; the eyelids became swollen with erythema. The tips of the fingers became bluish-black from embolic blocking during the attack in February, 1931. Petechiæ were seen all over the body.

There was considerable wasting, but anæmia was never marked; the hæmoglobin never fell below 50%. A blood-culture on 27.1.31 was sterile.

Kidney.—At one phase of the illness numerous red corpuscles were found in the urine together with granular and hyaline casts.

Spleen.—The spleen was not palpable during the illness.

Treatment.—Anti-streptococcal serum was given during November, 1930, in 10-c.c. doses, and an autogenous streptococcal vaccine made from the stools.

Present condition.—The temperature never rose after May, 1932, and there has been steady improvement since. The first sound of the heart is followed by a systolic bruit; there is no dilatation. The child has put on flesh, and is now getting about with more freedom, in spite of the stiffness in her hips.

Commentary.—Iacchia [1] reported a case of a child aged 5½, in which the course of the chronic endocarditis was three and a half years. In that case, however, the child died, and *Streptococcus viridans* was found in the blood-culture.

J. Comby [2] in June, 1930, records eighty cases of chronic endocarditis in children in the literature.

As regards the diagnosis in this case, the cardinal diagnostic signs were not all present. There was absence of clubbing of the fingers and of enlargement of the spleen, and the blood-culture was negative. However, the manifold embolic phenomena, combined with the prolonged pyrexia, make the diagnosis of endocarditis lenta difficult to resist.

Rist and Fischer [3] give a summary of this condition in a "Report of Twelve Cases in Children."

References.—[1] IACCHIA, P., *Pediatria*, 1931, xxxix, 603-605. [2] COMBY, J., *Arch. de Méd. des Enfants*, 1930, xxxiii, 366-70. [3] WILLIAM RIST and ALFRED FISCHER, *Amer. Journ. Dis. of Child.*, 1928.

Gastromegaly.—REGINALD LIGHTWOOD, M.D. (by permission of Dr. ROBERT HUTCHISON, M.D.).

K. A., a girl, aged 12 years, eldest in a family of four children, weighed only 3 lb. at birth, and was physically backward during infancy.

History.—Her health was good until four and a half years ago. Since that time she has been subject to attacks of vomiting, which last about a week, and she has had abdominal pain. The motions were often pale, loose and frequent, but she has had periods of constipation. The pain and vomiting have been worse during the last six months, and her legs have been weak, so that she has had to be carried up and down stairs.

Condition on examination.—Anæmic and stunted. Height, 42 in.; average at 12 years, 57 in. Weight, 35 lb.; average at 12 years, 81 lb. The cardiovascular, respiratory, nervous and urinary systems are normal. There is no evidence of rickets.

Blood: R.B.C. 2·24 million, Hb. 38% (Haldane); C.I. 0·8; W.B.C. 5,300 per c.mm.; one normoblast in counting 200 white cells; reticulocytes 0 in 500 R.B.C.; anisocytosis, poikilocytosis and achromia are seen.

Abdomen: Skin dry, abdomen distended. Percussion shows that the stomach is enlarged, and occasionally weak peristalsis is seen. Liver and spleen normal. Stools normal.

Barium meal: The stomach is much dilated and the barium shadow low in position. Peristalsis is weak and emptying is very slow, with a residue at six and a half hours. Fractional test meal shows hypochlorhydria.

Section of Psychiatry.

President—HENRY DEVINE, M.D.

[*March* 14, 1933.]

Some Aspects of the Psychopathology of Sex Perversions.

By J. A. HADFIELD, M.B.

ABSTRACT.—Importance of the study of perversions.

Precipitating causes. The attempt to explain them by the association of ideas or by simple conditioned reflex is inadequate.

Perversions are found to be the persistence of morbid reactions of infantile life.

The sex perversions have the same general causation, and the same mechanism as the other psychoneuroses.

The essential factor in causation is the feeling of deprivation of love: this interpreted biologically as well as psychologically.

Infantile sensuousness is to be regarded as biologically egoistic and not sexual. Its transference to the uses of sexuality later.

The perversions are not the mere persistence of these normal infantile tendencies but are morbid reactions to abnormal situations. These morbid reactions are further repressed, which accounts for the fixation and arrest of sexual development.

The precipitating conditions arouse the latent repressed tendencies, which therefore emerge in the form in which they were originally repressed.

SEX perversions are of interest to neurologist and psychologist alike, having an abnormality that appears, in some cases at any rate, to depend upon the physiological constitution, but which proves on investigation, and to judge by their cure, to be mainly psychological in origin.

It is strange that a function like sex, which is fundamental to life and necessary to the continuation of the species, should be so liable to perversion and so easily diverted from its natural aim and purpose.

A young man has his sexual instincts aroused only by shaking hands with an old man; another's sexuality is attached to shoes, or corsets, or the hood of a perambulator; a woman's sexuality takes the form of an impulse to murder any other woman with whom she finds herself alone, either in the country or a railway carriage. How are we to explain these extraordinary vagaries of nature?

Precipitating Causes.

By free association we trace back the symptom to the moment when it was first precipitated as a symptom, or to the occasion when it was first recognized as such. It is always an occasion when the sexual feelings were strongly aroused in association with some abnormal stimulus or activity.

A patient suffers from the sadistic desire to strangle the girl he is in love with. So violent is the impulse that on several occasions he has had to rush away from the presence of the girl whom his fingers craved to strangle. He traced this to an occasion in adult life when he was in love with a girl, and desiring to touch her breasts, he felt this terrible impulse.

Another who had a fetichism for corduroy trousers traced the first attachment of his sexual feelings to corduroy at the age of six when he was being given a ride on the back of a bigger boy wearing corduroy, and so had his sex organs stimulated.

Another man has the sado-fetichistic impulse to cut off the hair of girls in trains or elsewhere, which he traces back to the age of sixteen when he was watching a party of girls bathing—at that time with long hair—and suddenly felt this perverted impulse towards one of these girls to whom he was attracted.

These were the occasions when the perverted impulse was first recognized.

Now, such perversions may be explained quite simply as Association by the older psychologists, and Conditioned Reflex by the newer neurologists. According to this view a boy of ten, having had his sexual instincts first aroused by another boy, this association is fixed and determines his homosexuality. The first love of the youth at the seaside is associated with this attraction to the hair and so the link of association is made.

In the fetichism for corduroy trousers, the sex organs were stimulated by rubbing against the corduroy, which, thereafter, becomes a conditioned stimulus, and remains so even to the exclusion of ordinary sexuality.

These explanations are good as far as they go. Undoubtedly these experiences did help to determine the nature of the perversion.

But as a complete account of the origin of a perversion, these explanations are inadequate. If single experiences of this kind, in which our sexual instincts are for ever attached exclusively to the objects and stimuli which first aroused them, were a sufficient explanation of sex perversion, who of us would be saved!

Besides which, these experiences do not explain the whole symptom. No doubt the riding on the boy's back with the stimulation of the sex organs does explain the attraction to corduroy; but why corduroy trousers; why not a corduroy coat, which was the original stimulus, but which, in fact, produced no effect on his sexuality at all? The seaside association with girls may explain the attraction to hair; but why the impulse to cut it off?

Fortunately for ourselves, though not for our understanding of the problem, simple experiences like these are not sufficient to produce perversions; the causation of sexual perversions is much more complicated and demands further investigation.

Selecting the case of the fetichism for corduroy trousers, we find that it is the buttocks which are the chief attraction, with the two rounded lobes, soft, smooth and warm to the touch. Velvet would not do; it was too sticky. Moreover, the desire was to stroke and fondle them and to put his cheeks against them. Also the boys wearing them must be robust, healthy, athletic. The sex perversions have a way of being curiously specific, as in this case.

Now, these sensuous associations with the buttocks immediately carried him back to infancy where he experienced the same feelings towards his mother's breast as he now does towards the buttocks. Indeed, in going back and reviving this feeling in infancy he became entirely dissociated, and on several occasions would go through the whole process of feeding, making the movements of sucking for a few minutes, protruding his tongue every now and then, moving his hands upwards as though gripping the breast and making movements of fondling the breast; after sucking for a few minutes he would rest, and then return to the sucking with increased vigour until in about a quarter of an hour he would breathe deeply and lie back with a bloated, contented look on his face. He actually reproduced the whole experience of infancy, not in thought only but in feeling and action.

It was precisely these experiences which again appeared in the attraction towards the corduroy trousers—the same desire to touch and stroke and to press his face against their softness and smoothness. The buttocks with the corduroy were in fact a substitute for the breast. We find, in fact, that in all our cases of fetichism the objects are substitutes for the mother's breast, which is the child's first love object. Again, the hair sadist's first attraction to hair was not when he was fascinated by the girl at the seaside; but in infancy when he was being nursed by his mother, the tresses of whose hair hung over her shoulders so that the infant in fondling the breast would fondle her hair.

It is obvious, then, that for an explanation of these perversions we must go back much further than to the precipitating causes; we invariably find their origin in infantile experiences. We turn then to a study of the predisposing causes.

Sex Perversions and the Psychoneuroses.

In investigating the origin of the sex perversions we find them to be not essentially different, either in their general causation or in their mechanism, from the other psychoneuroses.

The most constant, though not the only factor, in the causation of the psychoneuroses, is the repressed craving for love.

Freud has suggested that the psychoneuroses are due to the repression of infantile sexual wishes. It would be truer to say that the psychoneuroses are due to the feeling of deprivation of love, the repressed craving for love.

Freud regards love as being essentially sexual. But love is protective as well as sensuous and the protective aspect of love is even more fundamental than the sensuous. The most fundamental need of every child is for safety and security, and the child's strongest and most fundamental desire is for protective love. It is in the very nature of childhood with its feeling of helplessness, that the child should have protective love. Deprived of this love the child falls into a state of helplessness, is incapable of adapting itself to life and so becomes neurotic. This is confirmed by observation of the behaviour of the infant, who in states of fear makes clinging movements for protection, and even in the absence of positive fear has the tendency, probably tropistic, to keep in close contact with the mother, or other person or object. This tropistic tendency, as we discover from analysis as well as from observation, is fundamentally protective.

This protection is amply provided for by the care and love of the mother, upon whom the child depends for food and warmth and life itself, and the child responds by love to the mother who thus provides it with all its wants and needs.

The attachment, however, to the mother is associated with sensuous pleasure, which serves to encourage the biological activity for protection. So the child finds pleasure in close contact with the mother, through whom it has this sense of security.

The various forms of psychoneurosis, hysteria, anxiety states, obsessions, are different reactions to a fundamental condition, namely, the feeling of deprivation of love, the repressed craving for love.

This is confirmed in analysis of psychoneurotic conditions: we find in practically every case that the patient goes back to, and experiences this craving for love and the feeling of deprivation. The fundamental elements in the sentiment of love are, therefore, the protective and the sensuous, and of these the protective is biologically the more fundamental. But since these inner cravings are, from the first, satisfied in the person of the mother, the child develops a personal attachment to the mother which we call *devotion*. Love is therefore, a sentiment, a group of emotional tendencies constellated round some object or person.

Now, this need for safety and security is not only biological but pyschological: the child not only needs the protective love of its mother, but feels the need of it; it not only is dependent upon its mother but feels its dependence.

It is not, of course, to be presumed for a moment that the child realizes in any intellectual sense that it needs protection, or that it is being deprived of love: but it can certainly *feel* and experience the sense of loss, the fear, the loneliness, the depression, the sense of need.

Given this protective love, the child first of all has confidence to face life; secondly, being given love it can afford to love others, and thirdly, in that atmosphere of protection and security it is free to express itself and develop its spontaneous life and activity, and so become mentally healthy.

On the other hand, deprived of this love, or feeling deprived of it, the child reacts abnormally towards life. Deprived of the sense of security, the child reacts by fear and anxiety, or it may react by feeling lonely and depressed, or feeling left out, its response may be that of self-pity, anger or hate. Finally, the child, deprived of its mother's love, may react by finding solace in abnormal, sensuous, or sexual activities, and resorts to thumbsucking, masturbation, or other auto-erotic activities. This is the reaction predisposing to the sex perversions.

Hysteria, obsessions and sex perversions are merely different reactions of the organism to the same fundamental situation: one person reacts by self-pity and dependence and becomes finally hysteric; another by hate, obstinacy and self-will and becomes the obsessional; another by finding solace in sensuous gratification and auto-erotism becomes the sex pervert.

This view of the origin of the psychoneuroses, including the sex perversions, is more in keeping with biological considerations than the view that they are all due to repressed infantile sexual wishes, for it emphasizes the *needs* of the child as well as its sensuous desires.

The sex perversions, then, are not essentially different, either in their ætiology or, as we shall see later, in their mechanisms from the other psychoneuroses, and, indeed, must be regarded as a form of psychoneurosis.

The sex perversions differ from the hysterias and obsessions only in type of reaction to these abnormal conditions in early childhood.

The reasons *why* one individual reacts in one way and another in a different way are too complicated to go into here and beyond the purpose of this paper.

We pass then, from the general ætiology of the psychoneuroses and confine ourselves to the specific sensuous reactions of the child and, in particular, distinguish between the *natural* sensuous activity of the child and the specific *morbid* reactions which end in the perversions.

Normal sensuousness of infancy.—Every child has certain biological functions—sucking, a clinging attachment to the mother, defæcation, urination, kicking its limbs—all of which are of biological value and necessary to the child's well-being.

All these biological functions are associated in their successful expression with sensuous gratification—it is pleasant to the child to suck, pleasant to defæcate, pleasant to be close to its mother. Moreover, it is obvious that the sensuous pleasure encourages the activity of these biological functions.

Pleasure, therefore, is not a mere subjective sensation divorced from the reality principle, it is a function of biological utility, encouraging functions necessary and useful to life. Fundamentally, far from being in opposition to the reality principle, it encourages adaptation to life. It may, however, under certain conditions become opposed to the reality principle.

So sucking, defæcation and urination are pleasant. If it is unpleasant to suck, as it is in cases where it is difficult, or the taste of the nipple unpleasant, it is obvious that the biological function would be discouraged. So if defæcation were painful it would produce, as it often does, the disinclination to pass motions and the health would suffer. But the association of pleasure with these activities encourages them. Such infantile sensuous activities are, therefore, perfectly normal and biologically valuable: and there is no justification for calling them perverse at this stage, or for regarding the infant as such as a "polymorphous pervert."

The tendency to regard everything from the point of view of the abnormal must be avoided if we are to keep a balanced judgment: after all if there were no normal there would be no abnormal.

Nor are we justified in calling these sensuous feelings sexual, for they are essentially egoistic and subserve functions essentially egoistic and self-preservative.

We do not accept as adequate Freud's reasons for calling these early activities sexual—namely, that they are continuous with later sexuality, and that they persist as the perversions.

Other activities, like the stimulation of the sex organs in early childhood, though they do not at the time appear to serve biological functions, later come to serve the functions of sexuality and reproduction, and may rightly, therefore, be described as sexual, even in infancy.[1]

These sensuous feelings, then, subserve the ends of the ego in encouraging biological functions *until these become established as habits*—habits of eating, defæcation, etc., when the pleasurable feeling tone begins to pass from them.

Later, however, these infantile sensuous activities become transferred to the uses of normal sexuality, as the wooing activities. We accept from Freud the view that normal adult sexuality consists of *two separate parts*—the wooing or preliminary activities, and the act of reproduction: and, further, that these wooing tendencies are the persistence of infantile sensuous activities.

Take kissing, for instance—it is nothing but a reproduction of the act of sucking, and both in the movements and in the noise of kissing we reproduce the activity of sucking. But while it originally served the egoistic function of feeding, it now becomes transferred to the uses of adult sexuality.

1 The terms sensuous, sensual, and sexual are here used in a somewhat arbitrary fashion to distinguish certain phases of activity and feeling.

We use the term *sensuous* of any pleasure of physical origin, sexual or otherwise, and both normal and abnormal; but usually of the normal pleasurable feelings of the body. Thumb-sucking or the pleasure in a warm bath is sensuous but not sexual. The term *sensual* we use not in the usual moral sense, but of the sensuous feelings in their more abnormal manifestations, as in excessive or neurotic auto-erotic activities and especially those which are divorced from their biological functions.

The term *sexual* has its biological and psychological significance, its main function being reproduction and its organs the organs of generation. Any stimulus or stimulation, therefore, of the genital organs, directly or indirectly, and whether actually conducing to reproduction or not, may be termed sexual. Thumbsucking is not sexual, masturbation is: the fact that they are both sensuous pleasure is not sufficient to make us identify them.

Activities and objects which were not originally sexual may come to have a sexual significance, like kissing, underclothes, and exhibitionism, when they stimulate the sexual feelings and activities.

Activities, therefore, which originally subserved egoistic self-preservation functions, persist and are transferred to the uses of adult sexuality, and are used in the service of reproductive functions and that of race preservation.

As the functions of these infantile sensuous activities were originally to subserve the biological functions in infancy, so now that they have been transferred into wooing tendencies, their function is to enhance the feelings of sexual excitement and so encourage normal sexual relations.

In thus being transferred to the uses of sexuality, these activities still remain normal.

But things do not always turn out so happily. In many cases, instead of being transferred to the uses of adult sexuality, infantile activities become perverted and persist *to the exclusion of normal sexuality.* They are then the true perversions. The perverted observationist may have no desire whatever for sexual relations with one of the opposite sex, but only to see another exposed: whilst the exhibitionist desires only to expose himself without any desire for sex relations: or he may consciously desire such relations but because of infantile attachments be unable to fulfil the sexual act. The fetichist may be sexually aroused only by the fetichistic object, be it shoes, corsets or corduroy trousers; and the homosexual may have no desires whatever towards those of the opposite sex, to whom he remains entirely indifferent sexually. So perverted infantile tendencies, instead of encouraging adult sexuality, actually inhibit them.

The main problem of perversions is why these infantile activities and feelings are arrested and fixated and persist to the exclusion of normal sexuality.

Perverted tendencies in infancy.—It is first of all necessary to note that perversions are not the mere persistence of the natural sensuous tendencies of infancy already described—though they may be derived from these—but are themselves morbid reactions of childhood.

The normal sensuous feelings of infancy are mostly associated with biological functions: the perversions are morbid reactions brought about by abnormal situations.

The craving to seize and possess what we sensuously desire is a normal activity of infantile life; sadism is not. It is only when the natural desire is denied that the child becomes sadistic and desires to destroy what it cannot possess.

The child has natural auto-erotic tendencies which are harmless and universal, and the child's early masturbation and thumb-sucking are a sensuous pleasure which in no way excludes the natural object love of the mother. But if the child is deprived of the love of its mother, it may turn away from the mother and turn into itself for sensuous gratification. This activity is not a mere substitute for the original love object; it is a reaction brought about by the deprivation of the original love object and the consequent rejection or repression by the child of the original love object. The child does not say "As I cannot have my mother, I shall find a substitute in my thumb-sucking or masturbation,"—and return to the mother when the opportunity arises. The resentful child says, "I don't want your love, I can find gratification in myself." The auto-erotism is now no longer natural and harmless, but is perverted.

The consequence of this neurotic reaction is that all its love is centred on itself instead of its having a real love object. Moreover, it is unsatisfactory to the child, being often associated with depression and self-pity as well as with self-love. It is, in fact, the first step towards a perversion.

The other perversions are similarly derived from morbid reactions of infantile life; one child, deprived of its mother's love may turn to auto-erotism, suck its thumb or play with its sex organs: another may find some substitute for the breast, like a silk handkerchief or soft quilt to hold and fondle, or a pillow which it hugs: or it may react with an aggressive assault upon the object of its love, biting, tearing at it: or if some other erotic zone, like the anus, is stimulated, it will find consolation in phantasies of that, or of the beating which stimulated its sexuality when the child was punished by the mother—and the child will indulge in masochistic phantasies.

These are the prototypes of the perversions: in brief when a child is deprived of love, protective or sensuous, it may reject the original normal love object and activity, and resort to a morbid reaction as a substitute which later constitutes the perversions. They are abnormal inasmuch as they are brought about by the repression of other tendencies, and so produce a "complex." So if we take any of the perversions, we find that they are not the perfectly normal and healthy sensuous feelings of infantile life, but perverted reactions arising from these. The attachment to hair was very natural to the child who fondled his mother's tresses when feeding; but why the sado-fetichism of cutting off the hair. This is

not an ordinary tendency of infancy but originated in a morbid experience in which, having got a strand of the hair in his mouth and throat he was half suffocated by it and turned in anger and fury against the object of his love and tried to destroy it.

So with exhibitionism, it is not the normal pleasure of exposure experienced by the child; but the activity of a child who, being deprived of love, tries to win it back by such exhibitionism. His sex organs are a source of pleasure to himself and he naturally assumes that they will be an object of pleasure to others, arousing in them the feelings they arouse in him.

But it will be obvious that even such morbid reactions are very common in infancy and yet comparatively few people are perverts in the full sense. How is it that these morbid reactions become *fixated* and *persist* in this arrested form, even to the exclusion of normal sexuality?

Two factors appear to be necessary—exaggeration of these tendencies, and repression.

Exaggeration.—(*a*) This exaggeration of the perverted tendencies may come about because of a previous exaggeration of the normal sensuousness of infancy. Most mothers take a sensuous delight in fondling their infants, and some over-indulge them so that they develop a high degree of sensuality. If such a child is first over-indulged and then deprived of love, it will, in the first place, naturally miss the sensual pleasure and so turn to morbid sensuality as a solace for the lost love; this sensuousness will naturally be exaggerated. This early exaggeration of sensuous pleasure may indeed determine why such a child develops a sex perversion, whilst another adopts a different reaction and becomes hysteric or obsessional.

(*b*) These reactions are also over-exaggerated because they are accepted and adopted as a substitute for the *whole* of the mother's love; the whole of love becomes concentrated on the sensual or sexual reaction, so that the child, having pushed away his mother and taking to masturbation or sadism, concentrates all his energy and love upon that. He clings tenaciously to it: it becomes his one joy in life, the only thing he lives for, so that it is not only exaggerated but a fixated activity.

To give a quotation from a masochistic patient. "I was alone and frightened and I wanted to get comfort by my sex organs. But I was prevented in doing this, which was my only escape from life. Yet I persisted and then was smacked and found I got the satisfaction in being smacked which I was not allowed the other way. But I *had* to go on doing it because it was everything I had in life, in spite of the prohibition, in spite of punishment."

When exaggerated, but not repressed, these morbid reactions are unwilling to give way to the normal developing sexual life of the adult. They therefore tend to persist—but not to the exclusion of ordinary sexuality: for the freedom of sexual expression in these cases leaves the sexuality partially free to develop to natural ends; so that while part of the libido may remain attached to the morbid activity, the rest of it may develop into ordinary adult sexuality, the perverted tendency then exists side by side with natural sexual desire. When this occurs they may be termed aberrations. We give the name "aberrations" more specifically to those abnormal sexual reactions which, whilst not excluding the ordinary sexual desires are, nevertheless, *preferred* to them: they are still perverted tendencies; but as they do not exclude ordinary sexuality, they are not complete perversions. A child who, by being constantly stimulated by enemata, develops a strong predilection for anal-erotic sensations, will have an undue desire for such sensations in adult sexual life, but this does not necessarily exclude natural sexual desire: so with sadistic, exhibitionist, and even homosexual tendencies, for there are many people who are fathers of families and so presumably have some natural sexuality, but who, in fact, prefer homosexuality. A man on leaving my consulting room one evening remarked that when he went on to Piccadilly it was a matter of complete indifference to him whether he picked up a young man or a woman. Others marry and have children but they may prefer to gratify their exhibitionist observationism, to having normal sexual relations. The fetichist may have sexual relations with his wife but may be more stimulated sexually by her corsets than by herself.

Perversions Proper.

Without further investigation, then, it would be natural to assume that all the sex perversions are due to mere exaggeration of infantile tenderness, and that they persist because they refuse to give way to the more developed forms of sexuality. We do not, however, find this to be the case.

So the youth who indulges in persistent masturbation may prefer this to normal relations and, indeed, sexual intercourse may be to him merely a form of masturbation in which there is neither love nor attraction to the woman as such.

The aberrations occur when the morbid reactions are exaggerated and are reluctant to give place to ordinary sexuality. They persist to the detriment though not to the exclusion of normal sexuality.

The aberrations differ from the natural wooing tendencies, for these are the simple persistence of early sensuous activities and definitely lead up to and encourage natural sexual functions: whereas the aberrations are morbid reactions, and whilst they may in the milder forms to some extent stimulate ordinary sexual desires, in the more advanced forms there tends to be set up a rivalry between them and normal sexuality.

Repression.

The very fact that these tendencies are morbid and exaggerated means that they are liable to repression. A child who resorts to masturbation is disapproved; or the anal erotism may lead to unpleasant consequences like nightmares; sadistic manifestations are punished and so must be completely repressed. This would not matter so much if it were only that *this* tendency were inhibited, but unfortunately with it *all* sensual pleasure is repressed and regarded as wrong. The individual is compelled to take up a moral or ascetic attitude of mind which represses any manifestation of sexuality as bad or dangerous: all sensual and sexual feelings may thus remain completely obliterated for many years. The result of this repression is that sexuality is arrested in development and the specific perverted impulse becomes fixated. The arrest and fixation of morbid tendencies are much more because of repression than because of mere exaggeration. These tendencies remain repressed until some stimulus, usually the physiological stimulus of the growing sexual life of the individual, arouses the sexual feelings when they again appear, and in the form in which they were originally repressed. These are the pure perversions.

In the complete perversion proper we find not only exaggeration but repression of the morbid reaction of early childhood.

The extent of the perversion depends on the degree of repression of the exaggerated tendency—the more it is repressed, the more it approximates to a true and complete perversion. That means that there is no hard and fast line between the aberrations and the perversions; but, for that matter, there is no hard and fast line between any psychoneurotic disorders which are really morbid reactions of the organisms as a whole. But this should not prevent us drawing distinctions which are not merely of value clinically but indicate a difference in ætiology.

This factor of repression is not difficult to demonstrate in the complete perversions, nor, indeed, in the extreme forms of aberration.

In the case of the sadist, in whom there was the impulse to strangle any girl with whom he was in love, the symptom ultimately took the patient back to his being at the mother's breast. When, after being indulged overmuch, not only with feeding, but in fondling after feeding, the child was being taken away, he fought and struggled to get the breast, seizing it and strangling it and finally biting it. This made the mother jerk him away and put him down to live down his passion in misery and dejection. Not only so, but the seizing and biting the nipple was accompanied by the taste of blood (which, in fact, he could taste again in recovering this incident); and, to crown all, he had his gums cut with excruciating pain (also re-experienced). All of these horrible consequences were associated with the biting, and compelled him to abandon his sensuous and aggressive desires, both of which he repressed and subjected himself entirely to his mother in submission and obedience. So complete was this submission that in adult life he felt not only that he could not marry any girl unless she were approved by his mother; but he must not marry any girl towards whom he had any sexual feeling.

The woman who suffered from the sexual obsession of passing water over the man she loved, traced this to an occasion when she was stimulated genitally by riding on her father's knee; when he desisted, she touched her own sex organs, which horrified her father who punished her and left her in a state of appalling fear and misery at his anger and departure, a terror which reproduced itself in anxiety states. She would do *anything* if he would only come back, and decided she must have nothing more to do with sex, which she now regarded as wrong and so terrible in its consequence.

In a case of sodomy there was pictured an experience of the child at eighteen months having eaten poisonous flowers, and being given an enema, which stimulated him pleasurably; but finally, having a stomach-tube administered, he became horribly sick and suffered from terrifying nightmares of slushy babies (himself) at the bottom of a long pole (the stomach tube). This naturally created the impression that the horrors were the consequence of his sexual feelings, which were, therefore, repressed.

In the case of the hair fetichist, there was original sensuous feeling of the hair at the breast; but he got some strands of the hair into his mouth and so he tore at it; but this sadistic impulse was followed by suffocation and terror, all of which he regarded as the consequences, as, indeed, they were in the literal sense, of his sensuous pleasure at the breast, which he, therefore, repressed and denied himself because of fear.

In the case of the fetichist for corduroy trousers, his infantile attachment was transferred from his mother's breast, which he was denied, to his mother's fur-coat. But when, at the age of three another baby was born, he became furiously angry and jealous, said he would have nothing to do with his mother, but would become big and independent and run away from home, which he did as far as the garden-gate. But there he was discouraged by seeing the rough boys in the street and he decided he must abandon this rebellious attitude and become the good, clever boy, finding his desire for approval as well as independence gratified in this standard.

The most common causes of repression are well illustrated in these cases.

In some cases the repression is due to the actual threat of withdrawal of the love and affection of the parent which is so necessary to the child. It is curious that in so many cases it is the feeling of deprivation of this love which in the first place makes the child resort to this morbid reaction, sometimes in anger, as in sadism, sometimes as a solace, as in masturbation; but these are then threatened by the parent with disapproval and the further deprivation of love, and so is repressed. The need of the child to keep in touch with those upon whom its safety and security depend, compels it to yield to their authority and repress its forbidden desires.

In other cases the repression is brought about by the actual consequences of the perverted tendency itself, quite apart from any disapproval of the parents. In one case, it was the sickness and nausea following on the orgasm in masturbation which led to depression and the abandonment of the habit; though here also a vicious circle is sometimes set up; the masturbation produces depression, and as a relief from the depression the child is forced to seek solace by masturbation. In other cases, it is the fear of injury sometimes threatened by adults; but frequently from actual pain in boys needing circumcision, or in girls making themselves sore.

One of the commonest forms of repression is that of nightmares following excessive sexual stimulation. Sexual indulgence in the child, especially if accompanied by an orgasm, is frequently followed by terrifying nightmares. In these nightmares the emotions of sex (or, in other cases, of anger) overwhelm the individual; the overwhelming emotions and feelings are then objectified and personified as ogres, vampires, monsters, and threaten to overpower the personality of the child and so produce terror. The child recognizes these as the consequences of the sexual feelings and is filled with dread at the consequences of its sexual passions, and so is compelled by fear to repress them. In such cases, a sex perversion is often associated with an anxiety state due to this dread.

According to the nature and kind of repression, the sex perversion will be associated now with fear, now with depression, now with obsessional acts.

We have reason to believe then that in all the complete perversion we have both exaggeration and repression of the early perverted reactions.

The exaggeration determines the persistence of the morbid tendency; the repression produces the arrest and fixation; if the morbid tendency were not exaggerated it would not hope to persist; if it were not repressed some of the libido, at any rate, would be transformed into more normal sexuality. When it is completely repressed and all sensual feelings with it, it is arrested, fixated, and produces a perversion.

It is because of this somewhat complicated mechanism—first the formation of a perverted reaction, then the repression of it—that whilst many people have minor forms of aberrations, due to the exaggeration of early perverted tendencies, with partial repression, comparatively few are complete sexual perverts.

Ideals and Standards.

Ultimately, the child is compelled by its fear, to repress all sensuousness, in favour of a new ideal, usually an ascetic or æsthetic one. It is often, curiously enough, people of refinement who suffer from sex perversions: which is to be explained by this repression.

The man with the fetichism for corduroy became a clergyman; the strangling sadist was in fact a magistrate who was excessively severe, on his own admission, upon offenders with violence; the sado-fetichist in hair became a lecturer in philosophy, the woman with the sexual obsession of passing water devoted herself to social work; the anal-erotic became a literary man and a poet.

These moral and refined standards of life are sufficient indication, quite apart from the discoveries in analysis, of the element of repression in the formation of perversions.

Precipitating Causes.

The precipitating causes are conditions and experiences which awaken and arouse into activity the repressed feelings and desires, so that they break through the repression. This stimulation may be accidental, but more often it is the growing physiological need of the adolescent or adult for sexual repression, which arouses the latent sexual feelings, and so precipitates the symptoms. This is made more possible by the fact that the original motives which caused the individual to repress the sexual tendencies have long since been forgotten and begun to weaken, as have the moral standards which he has imposed on himself.

The symptom.—When the repressed sexuality emerges it does so in the form in which it was originally repressed.

The specific form of the symptom depends upon the original perverted reaction in childhood: it is this which determines the type of the perversion.

In all the cases cited we discovered that the original perverted reaction, which was repressed, was the one which later emerged in the perversion.

So with all the other perversions; they are reminiscences of repressed morbid sensual activities of early childhood. The specific symptom, then, gets its character from the manner in which the child originally reacted to the feeling of deprivation of love.

This need for love with its element of loneliness is also very characteristic of sexual perversion in the present life of the pervert. The "well of loneliness" in which he lives is not due to the ostracism of society, but is inherent in the ætiology of the condition, and represents the need for affection, the absence of which originally compelled the child to find solace in the perverted activity. The perversion is the expression and symbol of a deeper need for love.

Indeed, it would be true to say of all sexual perverts that what they really seek is not sexuality, but a lost love: the perversion like the hysterical or obsessional symptom is a symbol of some deeper need.

The Physiological Factor.

One final note about the problem of the physiological constitution and temperament in its relation to sex perversions. We should not like to deny that there are some whose perversions are of a purely physiological origin. Such perverts naturally do not seek cure.

But that this is the main element in many of these perversions is disproved by their cure. If an individual were physiologically "made that way" it would be impossible by psychological treatment to cure him—yet many of them are cured.

It is mostly in the cases of inversion that the question arises, and it is often suggested that the male homosexual is feminine in physiological build, whereas the female homosexual conforms to the male type.

It would be truer to say that in both cases there is a *physiological immaturity*. The female homosexual is often said to be masculinoid; in dress and in manner this is often so, but she is not really masculinoid in physiological development. There are such masculinoid hairy women, but they are not usually or typically homosexual. The feminine homosexual has the boy-like figure, not the man's figure. She is, in other words, immature, lacking in adult female characteristics—roundness of body, large hips, etc., typical of the female.

Similarly with the homosexual male, he is not so much feminine as juvenile and immature. He is effeminate only in the sense of being undeveloped as a man.

This view, if it is true, would help to explain the sex perversions—for the physical immaturity would explain the retardation of sexual development, and therefore the tendency to more infantile reactions.

The individual with strong physiological sexual functions will drive his way sexually through almost any early conditions; the sexuality will assert itself in spite of any adverse circumstances.

If, however, the individual is constitutionally weak and immature sexually, he will be much more subject to abnormal conditions and more prone to fall victim to the infantile reaction of perversions.

We may conclude then, that whilst still the physical immaturity would act as a predisposing and contributory factor, the essential factors in the production of the majority of sex perversions are probably psychological.

The Psychopathology of Sexual Perversions.

By E. A. Bennet, M.C., M.D., D.P.M.

Abstract.—Current views on causation of sexual perversion.

An alternative to these, based on the relationship of the pervert with others, is put forward.

Sexual perversions and psychoneuroses are not positive and negative aspects of infantile sexual components.

Verbatim extracts from the analysis of a patient with sexual perversion are given to illustrate and support the following views: (*a*) The emotional relationship between the pervert and others is an essential element in the condition. (*b*) The physical aspects of the perversion are of secondary importance to the mental. (*c*) The perversion indicates a failure in personal and social integration; and an effort is made to alter this by means of aggressiveness, adopted child-like conduct, and perversions. (*d*) The perversions were manifold in type but uniform in purpose. (*e*) The policy of the illness was to regain a satisfying personal and social life. (*f*) The same policy is found in the psychoneuroses.

Current views upon sexual perversion are for the most part based on the work of Freud. The normal sexual life of the child, according to this school, differs from that which later is accepted as the normal adult standard. All children, it is held, exhibit in their undeveloped sexual life features which in the adult would be termed perversions.

Infantile sexuality, not yet subject to repression and unrestrained by education, is of a perverse character. The sexual perversions and psychoneurotic symptoms represent, then, the positive and negative aspect of the sexual impulses of infantile life.

In this contribution an alternative view is put forward. An effort will be made to show that there is no ætiological difference between sexual perversions and psychoneuroses, and that the former are not the residue of infantile sexuality persisting into adult life, but are morbid reactions arising out of abnormal circumstances. These reactions are used to regain that emotional state which prevailed in the relationship between the child and mother very early in life. The type of behaviour is moulded upon earlier experiences, but these are not of a sexual character.

No attempt will be made here to apply this view to the ætiology of the psychoneuroses. This was done elsewhere [1], and an endeavour was then made to show that hysteria could be understood as arising from the failure of the individual early in life to achieve the ideal inclusion in the community.

Later, the same theory was applied in the study of morbid anxiety, and the view was advanced that if the relationship of interdependence be disturbed a feeling of personal isolation supervenes which produces anxiety.

A somewhat similar view is put forward by Ian and Jane Suttie [2].

Freud [3] advances the conjecture that the phase of mother-attachment is specially closely connected with the ætiology of hysteria.

The effect upon the child of a disturbance of this relationship, and its later bearing upon social integration, is possibly the most important ætiological factor in the genesis of sexual perversion.

The opinions advanced will be illustrated by verbatim extracts, as given during analysis by free association, from the case history of a patient suffering from sexual perversion.

The patient was a married man, aged 29, and the symptom for which he sought treatment was a desire to experience what he described as a wet kiss with a little girl. Such a kiss was coincident with sexual excitement. The kiss, while it appeared the most desirable objective, was but a stage in a series of events. There were other perverse features, as will be noticed in the quotations given. It will be unnecessary to specify them.

The kiss was not an end in itself, but was a means towards an end. In the investigation certain essentials in the procession towards the desired end were noted. For example, "the child must be interested—the more surprise and curiosity shown by the child the better."

Not all children were attractive to this patient, even though they possessed the full rosy moist lips required if a satisfactory kiss was to be experienced. They must have that "come hither" look, or again that "forthcoming attitude." In other words, with the appropriate little girl there must be "complete contact" and a "breaking down of all reserves," "quite unclouded relations"—"no holding back," "no afterthought." "Above all what I sought in them was complete unobstructed intimacy," and "this must be unimpaired by any attitude of selfishness on my part. This relationship gives "an escape into something illimitable"—"it is the meeting on the same plane, neither questioning, complete naturalness and intimacy of personality, and not interfered with by any self-assertive element."

In later years he learned that during his babyhood his mother had a lover. She lavished affection on her baby as a surrogate for her lover, and this subsequently ceased. He was given love and affection, and soon after this was withdrawn. His references to his mother are always coloured with resentment. He felt entitled to a certain intimacy with her, but she failed him. He was aware of the change in himself which arose in consequence of this. Of it he says: "I feel what has happened is that I have excluded mother from my essential life, and I am now aware of a numbness towards her." Indeed he came to regard his mother as an intruder in his life. Yet he sought by devious means to recapture that which he had lost—"intimacy is the vital thing."

To reach this intimacy with another, a physical means—the kiss—was used. This, however, served a temporary purpose and was preliminary to an essentially individualistic state in which sexual or reproductive components were absent.

The essence of the intimacy lay in its emotional rather than in its sensational elements, and is expressed thus:

"I couldn't picture myself without that something in me which is appealed to, and I can get to the stage when I have no physical attraction. The infatuation is the thing, and is there when all about lips is absent. There is something in them which is further back than the physical and doesn't depend on physical appeal."

"The external—rosy wet lips—is merely a substitute and a poor one at that, for a little girl who would fling her arms round me—this is the appeal."

"I want the eyes that are not wondering all the time what you are going to do, and prepared to criticize or condemn it."

"My wife first attracted me with her eyes. My wife is cheerful and spontaneous and unlike my mother. But she is limited to being herself." Hence he experiences a feeling of isolation.

"The exhibitionism wasn't only sex feeling—it brought out an amused excited look in their eyes. There was in it something passive—an ecstasy of surrender."

The presence of perversion or psychoneurosis denotes a failure of social integration. This is preceded by a failure in personal integration or personal unity, which makes the normal progress to social integration impossible. There is in consequence an inability to share social life, and the attempt to do so is forced and unsatisfying.

The stages of development prepare the child for social life. When they are interrupted symptoms arise, designed to secure participation in social life together with the feeling of personal unity, which has become impaired. There supervenes a state of isolation which is exemplified by such phases as "I was like a bit broken off," "I felt quite unattached."

It is because this personal unity is lacking that the individual fails to attain social adjustment. Social unity is not reached because the personality, being disorganized, is by this very fact rendered incapable of social fusion.

The attitude of the patient to social life is illustrated in his own words:

"I felt in everybody that mattered around me some barrier, something which prevented me being natural. Anything I did was bound to be wrong. I have a picture of hemmed-in-ness, and I want to hit out badly."

"I wasn't congruent with my family in early days. They were puzzled and I wasn't able to put things right. I was inarticulate and clumsy in trying to explain myself to them. Right away back I had the feeling of being slightly different to other children."

"I have the vision of stretching out to feel personalities and missing it—never bringing off the meeting."

"There is the me I have created for the purpose of showing to the world, the me my mother sees and that I show socially, and that other me—the utterly simple child-like me, the me that is capable of instinctive devotion as against acquired affection, and it comes out in the best side of my relations with children."

The absence of personal unity is revealed here.

"I am never relaxed, always manœuvring for position, so to speak, and rather proud of my capacity for playing the chameleon and getting on well with all sorts and conditions of men."

These extracts make it clear that the patient had failed to secure social integration. A similar failure is, of course, observable in psychoneurotics. This supports the contention that sexual perversions and psychoneuroses are disorders of a like kind.

The patient's behaviour in a social environment varied. His chameleon attitude was adopted on some occasions; at other times he became aggressive; and under special circumstances he acted like a baby.

In each of these roles he had a goal in view, and this was the re-establishment of a social setting which would be personally satisfying.

This is best seen on those occasions when aggressiveness or babyishness was employed.

The following extracts reveal the patient's aggressiveness and show that its aim was either to secure happier social relationships, or to mark disapproval of existing ones.

"I can't get on with older people because in them there is not that spontaneity which I find in small girls and which calls up a like spontaneity in me. With older people points of self-interest conflict. I have an intense dislike for pretentiousness. When there is window-dressing I can't sit quiet—I become equally self-assertive."

In this and other places he meant by self-assertive what is more correctly termed aggressive, for others were involved and placidity was absent.

So again, "With small girls there is complete naturalness not interfered with by any self-assertive element; with them I have not to fight for recognition, but I am just taken for granted."

Turning now to the babyish attitude, it will be seen that by it, as well as by the aggressiveness, he seeks to mould those around him and to experience certain feelings himself.

"If I am ill, I have that babyish feeling of letting myself go to the personality of another person. All the aggressive side is put away, leaving something simple to the point of childishness—a letting go and enjoying it. When ill, I relax and let people do all the active things, and enjoy behaving in a silly babyish manner."

At the age of four our patient stole a rubber teat from a neighbour's baby and sucked it in bed. "It gave me," he says, "a curious satisfaction. They hunted for it and I said nothing. Then came their surprise and bewilderment when they found me with it in bed. Was

I wanting to be like a baby? It was all part of a design. I took it from the baby and when alone put it in my mouth. There was an association between the teat and the licking or wet kissing. I was aware that it was wet from the baby's saliva. I feel sure that at the time I didn't know why I wanted it."

"When I think of having the teat I feel now as I did tucked up in bed and I experience a sense of satisfaction. I am acting the baby. The babyishness had a common note with stealing the teat, and the common note is being a baby. Playing the baby always worked with mother and altered her attitude." To alter his mother's attitude was an important part of the matter.

Now we will see that the babyishness and the aggressive attitude were different methods of attending to some previously experienced state.

"In stealing the teat there was spite against the baby—a getting my own back, as I do with people now, and putting it in my mouth was an effort to get back to a previous state." "I took it from the baby to spite it because I was not allowed to sing, for this would disturb it."

"I see three things in the teat episode: First, spite in seizing it from the baby; secondly, getting attention; and thirdly, lying back in bed with the teat in my mouth and capturing some of the early serenity."

Here for the first time we get an indication of the meaning and purpose of his aggressiveness and of his babyish attitude—it is "to recapture something of that early serenity." Altering the attitude of his mother and other people was a step towards this.

Perversity in this patient took many forms, as we have seen. These variations, as well as the aggressiveness and babyish attitude served the same end, namely, "to recapture that early serenity."

The perversities were not the mere persistence of infantile sexual features, but morbid reactions used for a special purpose. At times they proved adequate and were employed repeatedly, at other times inadequate and hence discarded.

To quote: "My great mistake was in going along the wrong road; and of seeking more and more extreme ways of expressing what I wanted in small girls and not getting beyond to something else."

The aggressive attitude, the babyish attitude and the manifold perverse acts were directed to achieve a certain result, namely, the ideal social relationship with another—that is complete unobstructed intimacy. That he regarded the aggressive attitude, the babyish attitude, and the perversions as means to an end is made clear by the following quotation:—

"What characterized the early period is its static quality; people all around, no questioning. I take it all for granted. I just let myself go, I am childish and say babyish things. Apart from this everything belongs to a dynamic period, and my relations with people depend on an activity of my own. In the early period people look down and smile, in the later period I can't see their eyes as they are above my head. My relations with people in this later period depend on my activity—my tendency to be showing off, and the effect of fantastic incidents," by which he means the perversions. "I do fantastic things to attract response. This is the meaning of the exhibitionism—to attract the curiosity and attention of little girls. By conforming I didn't get attention, so I had to do the unusual thing."

A static quality in this early serene period contrasts with the striving which was so marked a feature of the later social life. The aggressiveness, babyishness and perversions were dynamic in character—restless. By means of these he was searching for something he knew not what. This restlessness is also a characteristic of the psychoneuroses. In the sexual perversions and psychoneuroses we find the same unsettled teleological state of mind. This might almost be taken as a diagnostic sign for these conditions. When this patient recovered what he described as the "early serenity" this restlessness passed away. It is an essential of growth that this restlessness be displaced by serenity. When we are something—that is, when we take no thought for the morrow—the future unfolds naturally. Patients always ask what they are to do. A more important question is what they are now doing. Adequate experience has a "presentness" untrammelled by first or final causes. It is its own justification. The happy future is implicit in the happy present. When, through interruption or rebuff, the early serenity is snatched away, there is a ceaseless

striving to regain it—now with perversions, now with psychoneuroses. When it is found, life can develop in a manner which is personally satisfactory and socially valauble.

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Section of Ophthalmology.

President—A. C. HUDSON, F.R.C.S.

CLINICAL MEETING, HELD AT ST. BARTHOLOMEW'S HOSPITAL, E.C. 1, MARCH 10, 1933.

A Comparator for Perimeter and Scotometer Charts (No. II).

By J. FOSTER, F.R.C.S.

Those parts of the visual fields within about 25° of the fixation point can be mapped more easily and more accurately upon a scotometer than upon a perimeter. In many cases this area includes the whole field for coloured objects, and for small white objects. It is desirable that these fields shall be compared with those obtained for larger white objects. We can mark out both types in freehand upon a perimeter chart, but this means that the additional accuracy of the larger scale scotometer chart is sacrificed. It is suggested that those fields taken upon a scotometer should be recorded upon their proper scotometer charts, and that a comparator should be employed either for visual comparison, or in order to permit a small scale drawing to be made upon the perimeter chart.

The instrument is a camera lucida. The scotometer chart is held in spring clips upon a vertical board. The perimeter chart is similarly held upon a horizontal board. Immediately over the centre of the perimeter chart is an eyepiece, the observer looks downwards through the eyepiece and can see the perimeter chart through it. A weak convex lens is provided to assist accommodation. In the path between the eye and the perimeter chart is a half-silvered mirror, which reflects light from the scotometer chart into the same eye that is viewing the perimeter chart. Between the mirror and the scotometer chart a concave lens is placed, reducing the size of the scotometer chart as seen by the eye to be of the same scale as the perimeter chart. The factor of reduction required will vary from about eight to about three, depending upon the two charts employed. The concave lens will have to be altered in power to give the correct figure. Small adjustments of position with respect to the eyepiece will give a small variation of power and of focus. Slight twisting of the eyepiece will bring the virtual image of the scotometer chart to the centre of the perimeter chart.

At present as there is no erecting lens inserted, the perimeter chart has to be reversed before the scotoma image is pricked through it.

Brown Line in Cornea.—A. C. HUDSON, F.R.C.S. (President).

I first described this condition in 1911 in the *Royal London Ophthalmic Hospital Reports*. It has since been described by Staehli,[1] and has received his name. It is fairly commonly seen in routine examination. Voght has carried out a good deal of work on such cases, and his impression is that a rupture of Bowman's membrane has occurred. He found beneath the membrane a brownish granular deposit. I do not know whether this view as to the ætiology of these lines is accepted without question.

[1] *Klin. Monatsbl. f. Augenheilk*, 1920, lxv, 106.

Two Cases of Angiomatosis Retinæ.—R. FOSTER MOORE, F.R.C.S.

Both these patients are women; both have one eye quite blind from extensive angiomatosis of the retina and each has an angioma in the other eye. One patient came to Mr. Rupert Scott, at the Royal London Ophthalmic Hospital, and he was good enough to transfer her to me. She had previously seen Mr. Heath, of Rochester, who diagnosed the condition. She had a small angioma towards the temporal side. I treated it by putting radon seeds outside the sclera at a point accurately corresponding with the growth, as far as I could judge it. I used three 4-millicurie seeds, and left them in for ten days. There is now no angioma; it has scarred up.

The second patient also has one eye destroyed by the condition. I show you an illustration of the condition in the other eye [not reproduced]. In this case I inserted only two radon seeds of 2-millicuries, and left them in for three days only. They were put in three weeks ago, and I am not sure that the dose in this case will prove adequate. If the angiomata are not soon obliterated, I shall put in stronger seeds and leave them *in situ* longer. I used weaker seeds, fewer in number, and left them in for a shorter time in this case because I felt the scarring in the first case was perhaps unnecessarily extensive. Unless the process can be stopped, I fear this eye will go the same way as the other. An unfavourable point about the case is the presence of a number of little aneurysmal dilatations, in the retina, rather wide of the two main growths.

The PRESIDENT said that these cases were of extraordinary importance if the results of the treatment meant that it was possible to check the progress of this vascular abnormality. He assumed that the same treatment would also be applicable to more generalized vascular disease, such as was met with in some cases of recurrent hæmorrhages.

Metastatic Endophthalmitis.—R. FOSTER MOORE, F.R.C.S.

The patient is a boy, aged 10, who has only just been admitted into a medical ward of the hospital, and consequently information about him is incomplete. The history is that three weeks ago he fell down while roller-skating, and broke his right internal epicondyle. A week ago he became blind in the right eye, and had a purpuric rash—he seems to have panophthalmitis in his right eye, with pus in the anterior chamber. There are a few petechial hæmorrhages in the palpebral conjunctiva of the other eye. He has no elevation of temperature now, but it has been 102°. The blood-count shows 12,000 white cells. It clearly is a metastatic infection, and one wonders whether it may prove to be infective endocarditis.

Glioma Retinæ.—R. FOSTER MOORE, F.R.C.S.

I have shown this boy on two previous occasions.[1] His brother had a double glioma of the retina; both eyes were removed, and he died. This present patient was first under the care of Mr. Rupert Scott, who was good enough to pass him on to me. In November, 1929, Mr. Scott removed one eye, and demonstrated glioma in it; he was then found to have a growth in the other eye. I put a radon seed in at that time, and I show you a picture of the appearance on February 14, 1930 [not reproduced]. We have been watching him at six-weekly intervals since. There are extensive changes in the choroid, which may be due to too much radium having been used. But he still attends school. When last seen his vision was $\frac{6}{18}$. He is now aged $8\frac{1}{2}$ years and is fairly well. The mother refused to have the second eye removed, and one is not surprised at her decision in this case, having regard to the failure of this procedure to save the previous child.

[1] *Proceedings*, 1930, xxiii, 475 (Sect. Ophth., 35); 1931, xxiv, 1041 (Sect. Ophth., 47).

Familial Macular Degeneration in Twins.—HUMPHREY NEAME, F.R.C.S.

Winifred and Dorothy H., twins, aged 11 years.

July 6, 1932.—Examined at the Royal London Ophthalmic Hospital.

The vision of the children was reported to be defective on examination at school.

Family history.—The father, aged 46, was an out-patient at the hospital some years ago, and was stated by his wife to have been, for three months, so blind that he had to be led. His sight recovered, and he was afterwards able to do agricultural work, and to read. He had made no complaint of his eyesight since then. One sister, aged 16 years, was stated to have good sight. No others in the family.

Condition in July, 1932.—Both children were healthy in appearance, and seemed bright and intelligent. The vision was reduced to 3/60 with glasses. There was good binocular fixation. The maculæ showed very delicate pigment changes in the central area.

Cysts of the Retina with Cholesterin Crystals in or behind the Retina.—HUMPHREY NEAME, F.R.C.S.

Mary McN., aged 25.

History.—Patient said that the sight of the left eye had failed gradually during the past four or five years. At the age of 14 years the sight had been tested at school, and had been passed as good. No history of injury to the eye, or of any serious illness in recent years.

Present condition.—Healthy appearance. Right vision, $\frac{6}{6}$. Good direct action of pupil, very little consensual. Left vision: Perception of shadows; pupil larger than right, with very little direct, but good consensual reaction. The left fundus is remarkable for the presence of numerous brilliant iridescent crystals of flat appearance, widely distributed in the posterior part of the eye, deep to the retinal vessels. The fundus colour is dull. No hæmorrhages are seen. In the far temporal periphery two contiguous rounded prominences project into the vitreous. These do not undergo floating movement after movement of the eyeball. The optic disc is not so sharply defined as that of the right eye, and is discoloured, but not definitely atrophic.

Cyst of Left Retina. Detachment of Right Retina (cured).—RUPERT S. SCOTT, F.R.C.S.

Miss D., aged 53. In June, 1932, lost the upper portion of the field of vision of the right eye, which had previously had better vision than the left.

When I saw her in December, the right fundus showed a large detachment involving the temporal and lower portions of the retina. Near the temporal periphery of the detachment was a large oval hole measuring about four by three disc diameters. The temporal portion of the choroid exhibited a large area of scarring underlying a part of the detachment. Vision of this eye was $\frac{6}{24}$.

In the left eye there was a large globular translucent swelling, which I took to be a true retinal cyst, in the temporal periphery of the retina.

The patient was admitted into the Royal London Ophthalmic Hospital, where I operated upon the right detachment by endothermic cauterization. The detachment subsided immediately and has remained cured. The vision of this eye is now $\frac{6}{18}$. There is still a nasal defect in the field, due to the temporal scarring.

The case is shown on account of the presence of the cyst in the left retina.

Miss Kyle, of Southampton, to whom I am indebted for the case, says that the cyst has definitely enlarged since she first observed it in August, 1932. It is feared that it will eventually rupture, causing a detachment, and therefore it is suggested that operation by endothermic cauterization and external puncture should shortly be carried out. It is thought that a similar cystic condition was previously present in the right retina.

Mr. HUMPHREY NEAME said he would suggest—assuming that Mr. Scott would operate—that the outer wall of the cyst should be dealt with, rather than the inner wall, because in the sections of such cysts which he had seen the outer was the thinner wall, and was stretched more than the inner. Therefore, in order to give the retina the best chance of avoiding rupture at a later date, the better plan would be to make a hole in the outer wall or to remove it.

Swelling of Optic Discs. ? Cause.—RUPERT S. SCOTT, F.R.C.S.

Mrs. N., aged 40, first attended this hospital in March, 1932, having been told elsewhere that she had optic atrophy.

At this time she suffered from headaches which, however, disappeared after treatment for intestinal toxæmia.

Examination by a neurologist had not revealed any abnormality other than the condition of the discs. The general condition is now good.

Both discs show three dioptres of swelling. There has been no appreciable change in their appearance during the past year, and neither hæmorrhages nor engorgement of the vessels have been observed. The refraction is approximately emmetropic.

In March, 1932, the vision of each eye was $\frac{6}{9}$. The vision of the right eye is now $\frac{6}{18}$; that of the left eye is $\frac{6}{12}$.

Both blind spots are definitely enlarged, but otherwise no field defect has been discovered.

The PRESIDENT said that if this condition had occurred in a child he would have thought of the possibility of its being due to intracranial tuberculosis. He recalled one case, probably of tuberculoma of the brain—in a child—in which swelling of the discs persisted for many months, and eventually subsided, leaving very little affection of the sight. Apparently, however, there was no reason to suspect tuberculosis in the present case.

Pulsating Exophthalmos : Arterio-Venous Aneurysm.—C. B. V. TAIT, M.B.

Mrs. M. C., aged 27, seen in October, 1932, giving the history that two days previously there had been sudden and intense pain in the head, followed next day by noises in the head and redness and swelling of the eye.

On examination.—Pulsatile exophthalmos of the left eye, together with almost complete external ophthalmoplegia. Vision in the left eye was less than $\frac{6}{60}$, and in the course of a few days only hand movements could be appreciated, while the eye became completely fixed and the lower conjunctival fornix chemosed. The noises in the head became so severe as to interfere with sleep, but these could be controlled by compressing the vessels on the corresponding side of the neck.

The Wassermann reaction was negative and skiagrams of the orbit revealed no abnormal shadow.

During the past five months there has been a gradual abatement of symptoms. The patient is now able to move her eye more freely, and her vision has so far improved as to be able to recognize faces.

There are now numerous hæmorrhages in the fundus, whereas originally it was normal, except for dilatation of the veins. There is no history of trauma.

Discussion.—The PRESIDENT said that he agreed with the diagnosis: Most of the characteristics of arterio-venous aneurysm were present, including the bruit. Had any general surgeons been consulted about this case? and if so, what operation (if any) did they suggest?

Mr. T. HARRISON BUTLER said that he had had a case similar to this, upon which Mr. Frank Barnes, surgeon at the Birmingham General Hospital, had operated, ligaturing the internal carotid artery, and there had been no untoward incidents. From one point of view the procedure was not very successful, but it certainly did no harm.

Mr. TAIT (in reply) said that the general surgeons who had been consulted were not anxious to do anything; they seemed to be dissuaded by the possibility of hemiplegia resulting from surgical interference. The noise had been gradually diminishing, and the patient seemed content to go on without operation. There had been recently another case of the kind in the department—associated with trauma, and it had terminated by a sudden intracerebral hæmorrhage and death.

Uveoparotitis.—C. B. V. TAIT, M.B. (for RUPERT SCOTT, F.R.C.S.).

S. J., male, aged 27, first came under observation in April, 1932, having, for three weeks, had mistiness of vision with focusing defect associated with enlarged glands behind the angles of the jaw.

On examination.—The left eye showed slight ciliary infection, together with some keratitis punctata. The pupils were semi-dilated and reacted briskly to light but sluggishly to accommodation. Complete cycloplegia left. Vision: right, $\frac{6}{6}$; left, $\frac{6}{6}$.

There was painless enlargement of both parotid glands.

The patient was treated with atropine drops, 1% to both eyes. Left facial palsy developed two weeks later and was followed in the course of a few days by right facial palsy. Associated with this were sensations of pins-and-needles over the middle, ring, and little fingers of the right hand, and over the right shin.

A few dots (K.P.) could now be seen in the right eye, while numerous ones were present in the left eye in which the media were hazy and the retinal veins engorged.

The voice had become hoarse and the right leg weak. Examination revealed weakness of palatal muscles, fixation and abduction of the right vocal cord, and absence of right knee and ankle jerks. All these resolved during the course of a few weeks.

At present the right vision is reduced to $\frac{6}{60}$ on account of the numerous opacities in the vitreous. Ciliary flush is still present, together with a good deal of keratitis punctata distributed over the lower part of the cornea, while the pupil is well and evenly dilated.

The left vision is $\frac{6}{6}$ partly. Some keratitis punctata can still be discovered, and there are some posterior synechiæ, formed since the discontinuance of the mydriatic to that eye in order to allow the patient to work.

Facial weakness remains a marked feature, and an enlarged gland is palpable behind the angle of the left jaw.

The pathological findings were negative.

Foreign Body in Left Eye for Twelve Years.—T. H. WHITTINGTON, M.D.

H. B., male, aged 59.

In September, 1920, when he was chipping concrete above the level of the eyes, a piece of steel entered the left eye. Foreign body localized next day, 23 mm. back from centre of cornea. Secondary glaucoma as result of traumatic cataract occurred on third day, and lens matter was evacuated. Lens matter further absorbed, and by about February, 1921, the piece of steel was seen in the retina, exactly as localized. There then appeared absolutely no disturbance around it apart from some spots which looked like old hæmorrhage. Right vision = $\frac{6}{6}$. Left vision: Counts fingers at 18 in.; good field.

Seen at intervals for another year; the eye remained quiet and the spots around the foreign body disappeared. Came to hospital in 1923 for change in glasses. Eye then stated to be healthy but no note made of fundus. Not seen again until December, 1932, when he complained of loss of all sight in left eye, and distortion of objects in centre of right field of vision, so that he could not work to a straight line (he is a bricklayer). Very widespread changes in left fundus, brown deposits on back of left cornea, early macular changes in right eye (see pictures A, B, C). Right vision = $\frac{6}{12}$ distorted. Left vision: No perception of light. Fundus changes in left eye are

characteristic of siderosis retinæ. They show sclerosis and obliteration of retinal vessels (due to disease of endothelium and consequent closure of lumen), with resulting atrophy of retina. Displacement of retinal pigment to be deposited in anterior layers of retina. There are brown deposits on the remains of the lens capsule, not what one usually sees in siderosis. The slit-lamp shows on the back of the cornea brown deposits near the periphery, limited to the lower half of the cornea. How far the siderosis accounts for the rest of the changes I do not know. There are some slight pigmentary changes at the right macula, and there is evidently some early macular retinitis which accounts for the symptoms.

Mr. Mayou, in 1925, dealt with the subject of siderosis, and pointed out how the colloidol iron seemed to have a poisonous effect on the pigment cells—that these cells died, and pigment from them became deposited in other places. By no means all the pigmentary changes seen were due to deposits of iron; some were due to deposits of retinal pigment.

There have never been inflammatory signs in this left eye. I ask for opinions as to the early changes in the right macula; can these be due to a foreign body in the left eye $12\frac{1}{2}$ years ago? I think not.

Discussion.—The PRESIDENT said that the appearance in the left eye was such as would be expected at a late stage in a case of retained foreign body, i.e., degeneration in the retina and complete optic atrophy. He recalled a case under the care of Mr. Morton at the Royal London Ophthalmic Hospital, which formed a very beautiful example of siderosis of the retina, and in that case there was some optic atrophy in the other eye. Did any members know definitely whether one eye could be affected by the retention of a foreign body in the other?

Mr. J. FOSTER said that when writing an article on eye injuries in relation to the Workmen's Compensation Act he had looked up records of cases in which, though a foreign body had been retained in the eye for a long time, good vision had been preserved. In 36 cases the foreign body had remained in the eye many years. In Hirschberg's series there were cases in which iron had remained in for seventeen and thirty-two years, without loss of vision. In 17 cases the foreign body was in the retina. He had always hoped that at such a meeting as this some of the senior members would quote cases of intra-ocular foreign bodies in which the vision was long preserved.

Projection Protractor for Use with a Bjerrum Screen.

By J. W. TUDOR THOMAS, F.R.C.S.

ATTEMPTS have recently been made to simplify the transference of the boundaries of a scotoma or visual field from a Bjerrum screen upon which they have been mapped, to a scotometer chart for permanent record. The cellophane protractor recently introduced by Mr. J. Foster is very successful for one-metre screens, but when discussing with Mr. Foster and the instrument-makers, its application to a two-metre screen, it was agreed that it could not be simply applied. Mr. McKie Reid has since suggested a modified transparent protractor which can be pinned to each quadrant of a two-metre screen in turn.

The projection of thin white lines cut in an opaque mask had been tried by Mr. Foster, but did not prove satisfactory. The present instrument was then constructed, using a very bright source of light and a transparent slide with black lines upon it. The projected lines show up quite clearly on a Bjerrum screen.

The instrument is essentially a projection lantern. The carrier has an adapter, so that it will also take microscope slides in place of the protractor slide. The four-component projection lens is free from distortion, and its position with respect to the slide can be varied to give a sharp focus for different distances.

As a distance varies, so the magnification of the slide produced on the screen will vary. The screen picture will be required to be either one metre square or two metres square, corresponding to distances from the instrument of about two and a half and five metres respectively, when a slide of standard size is used. The instrument is made to stand upon a small shelf on the wall of the room opposite the screen, so that the distance from the screen will be fixed, and very likely will differ from the two distances stated. A slide of special size can be made, however, which will give the correct projection size for the given distance. Alternatively, the instrument could be placed on a table or stand, a certain height and distance from the screen, and adjusted to correspond with the fixation spot. Pieces of tape can be supplied, subtending a given angle when pinned on the screen, and so enabling the adjustment to be checked.

A test has been made of the accuracy of the diagram projected upon the screen. The maximum error found was equivalent to an error in measuring the position on the screen of less than a millimetre.

The slide could be made to project an enlarged facsimile of any perimeter or scotometer chart. The standard slide projects radial lines of 15° intervals and concentric circles subtending 5° intervals to the patient's eye. It is suggested that a slide should be employed with radial and concentric lines to agree with the chart employed. The screen will then be divided up into areas corresponding exactly to those on the chart, making transference as easy as possible.

The instrument is mounted upon a base with three levelling screws. These will enable the projected image to be correctly set.

Two Cases of Irradiation Cataract.—J. G. MILNER, F.R.C.S.

(I) Mr. J. M., aged 67, attended St. Bartholomew's Hospital in 1928 for a recurrence of a rodent ulcer involving the upper and lower lids of the left eye. Eight years previously he had had a rodent ulcer removed from this site. In April, 1928, the ulcer was treated by radium barrage, nine needles being used. The total dose was 624 mgm. hours.

Seen again January, 1933. There is a healthy scar, and no recurrence of the ulcer. Vision in the right eye is $\frac{6}{12}$ corrected, and in the left $\frac{6}{24}$. In the left eye there are post cortical lens opacities, which have a vacuolated appearance, and which I believe to be due to the radium.

(II) Mr. J. K., aged 53, attended St. Bartholomew's Hospital in April, 1929, and a diagnosis of rodent ulcer of the inner canthus of the left eye was made. He was treated by radium needles, seven in number, a total dose of 1188 mgm. hours.

He was seen again in January, 1933, and was found to have post-cortical lens opacities in the left eye, very similar to those seen in Case I. Vision in each eye is $\frac{6}{9}$.

I am indebted to Mr. Foster Moore for permission to show these cases.

Discussion.—Mr. H. B. Stallard said that he believed the explanation of these lenticular opacities occurring at some latent interval after irradiation in the vicinity of the eye was that there was defective nutrition of the lens, owing to alterations in the capillaries of the ciliary body. These changes were represented by vaso-dilatation and hyaline degeneration in the neighbouring tissues. Experimental work had shown paralysis of the cells of Rouget in the capillary walls and stagnation of the blood-stream.

The PRESIDENT said these two cases raised a question as to how much radium it was safe to use for such conditions as rodent ulcer of the eyelid. Often it might be best to take the risk of cataract developing, as the lid condition was such a serious one. Was there any reason for thinking that young people were less liable than older ones to develop cataract as a result of the application of radium?

Mr. FOSTER MOORE referred to the case of a small baby into whose eye radon seeds were inserted on account of a glioma of the retina; the baby was about 2 years old. Extensive

lens opacities had then developed, but within three months these had all disappeared. In the cases reported by Mr. Milner, however, the opacities were late developments, and seemed to be of a different type.

The PRESIDENT asked whether there was a possibility of the opposite eye being affected by the radium?

Mr. FOSTER MOORE said he did not think that the rays were sufficiently penetrating to affect the other eye.

Six Cases of Metastatic Carcinoma of the Choroid.—H. B. STALLARD, F.R.C.S.

Metastatic carcinoma of the choroid is a rare disease. The statistics for the six specimens described amount to 1 in 140,000 patients attending the out-patient clinics of an eye hospital. Of these the primary neoplasm was in the breast in three cases, in the lungs and bronchi in two, and in the bladder and prostate in one. Four were in females and two in males. Four were between the ages of 59 and 66, one was aged 43, and another only 31.

In the three cases—all in females—in which the primary carcinoma was in the breast, the interval between the surgical treatment of the primary neoplasm and the detection of a metastatic carcinoma in the eye was two and a half years in two cases, and seventeen years in the third.

In the two cases in which the primary neoplasm was in the lungs and bronchi, the metastatic deposit in the eye was the first evidence of any trouble, and the site of the primary growth was not detected till later.

No reliable history was obtainable about the patient in the sixth case, in which there was a primary neoplasm in the bladder and prostate, for he was in prison during the course of his disease, and died shortly after his release.

In this series both eyes were affected equally, in three the right eye and in three the left. The average length of life after the discovery of the metastasis in the eye was between four and five months.

In the three specimens from cases in which the primary growth was in the breast the metastasis in the choroid is flat and diffuse, beginning at the posterior pole and extending forwards in the lymphatic spaces of the choroid. The cut surface is stippled and shows grey translucent areas and reddish-brown dots. The overlying retina shows a shallow detachment. The islands of carcinoma cells resemble the tubular or acinous arrangement of the primary growth. Hyaline degeneration is present in the stroma; the chromatophores are distorted and rolled up into little brown spherules, and the neoplasm is relatively avascular. Lymphocytes are evident at the advancing edge, and there are areas of degeneration. The sclera is infiltrated in some cases. A plug of carcinoma cells occupying the lumen of a posterior ciliary vessel is seen in one specimen.

In the two specimens from cases in which the primary neoplasm was in the lungs and bronchi, the metastasis in the choroid presents a more solid, thicker mass than in those cases in which the primary growth was in the breast. Also it is more localized, and is not diffuse. The stroma is sparse, and the cells have an adeno-papilliferous arrangement with clear spaces and fine, branched connective tissue trabeculæ.

In the sixth case, in which the eye was removed post mortem, the specimen shows a very extensive mass of carcinoma cells, and represents an advanced stage of the disease.

Details of the history, the macroscopic and microscopic appearances of these cases are given in the case notes.

I have to thank Mr. Foster Moore, Mr. Goulden, Mr. Whiting, Mr. James, Mr. Duke-Elder, and Mr. Nutt, for sending me these specimens and for permission to show them.

(I) M. L., female, aged 66. Primary carcinoma in left breast. 1912: Amputation of left breast and dissection of axillary lymph-nodes.

1929 (seventeen years later), left vision became defective. The retina was detached and the eye was excised on account of pain. Secondary metastatic deposits were present in the anterior mediastinum at the time of excision.

Macroscopic appearances (fig. 1).—There is a diffuse thickening of the choroid

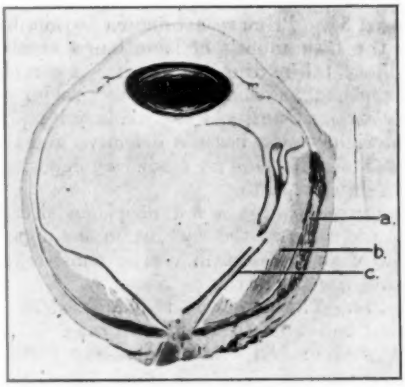


FIG. 1 (Case I).—a. Islands of carcinoma cells in the choroid. b. Subretinal fluid. c. Detached retina.

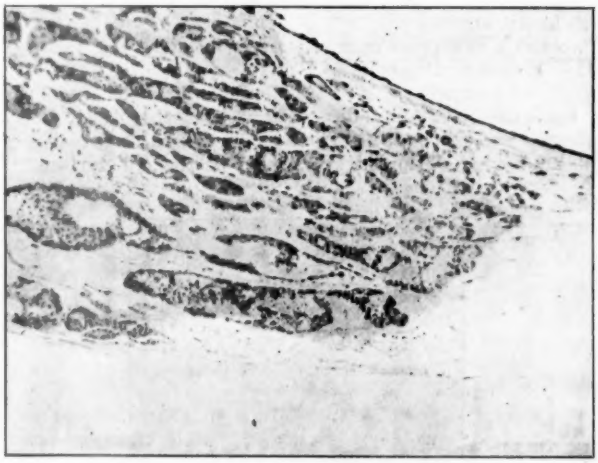


FIG. 2 (Case I).—A photomicrograph showing islands of carcinoma cells in the lymphatic spaces of the choroid.

between the optic disc and the ora serrata on the temporal side, and to a point half way between the optic disc and equator on the nasal side. The cut surface has a stippled granular appearance, and the consistence is of a firm elastic nature. A shallow detachment of the retina is present over the site of the neoplasm.

Microscopic appearances (fig. 2).—The carcinoma cells are disposed in irregular clumps in the lymphatic spaces of the choroid. Some of the malignant cell masses

have a tubular shape and others show an attempt at acinous formation. Mitotic figures are present. The chromatophores are rolled up into little brown spherical masses. The connective tissue of the choroid is undergoing degeneration at some sites. Except for a few capillaries in the region of the equator the neoplasm is avascular. Two of the short posterior ciliary arteries on the temporal side have malignant cells in their lumina and in their perivascular lymphatic spaces as they pierce the sclera.

(II) A. T., female, aged 31. Primary carcinoma in left breast during lactation.

February, 1927, in the fifth month of lactation, a small, hard, irregular lump was present in the axillary tail of the left breast. A complete Halstead operation was performed. The neoplasm was composed of spheroidal carcinoma cells having a trabecular and tubular arrangement, and two axillary lymphnodes were affected.

September, 1929, the right vision became defective and the retina was detached. The eye was excised, and at this time no secondary deposits were seen elsewhere.

The patient died in February, 1930.

Macroscopic appearances.—There is a flat neoplasm situated in the choroid and extending between the optic disc and the equator in the upper half of the globe. It has a granular appearance and is of firm elastic consistence. A shallow retinal detachment is present over the site of the neoplasm.

Microscopic appearances.—The neoplasm is composed of spheroidal cells having an irregular tubular and trabecular arrangement and infiltrating the lymphatic spaces. Areas of degeneration and cystic spaces are present. The sheath of a posterior ciliary nerve is invaded. There is much fibrous tissue stroma and some lymphocytic infiltration at the advancing edge of the neoplasm.

(III) S. S., female, aged 60. Primary carcinoma in left breast.

1928.—Left breast amputated.

1930.—(Two and a half years later) right vision failed.

April, 1931.—Excision of right eye.

July 1, 1931.—Admitted to Romford Infirmary with metastatic deposits of carcinoma in the axillary lymphnodes. Died, August 1, 1931.

Macroscopic appearances (fig. 3).—There is an extensive invasion of the choroid by a flat neoplasm having a stippled appearance of the cut surface. The retina is detached.

FIG. 3 (Case III).—a. Islands of carcinoma cells in the choroid. b. Extra-ocular extension at site of posterior ciliary vessels. c. Extension of carcinoma cells into the optic nerve.

Microscopic appearances (fig. 4).—The neoplasm is composed of spheroidal carcinoma cells which have an acinous arrangement. Some of the cells are degenerate and form masses of granular débris and coagulum. The choroid is infiltrated along the lymphatic spaces. Fibrosis and hyaline changes are present in the stroma and the chromatophores are distorted. The retina is infiltrated in the vicinity of the optic disc, and extra-ocular extension has occurred through the optic disc and into the

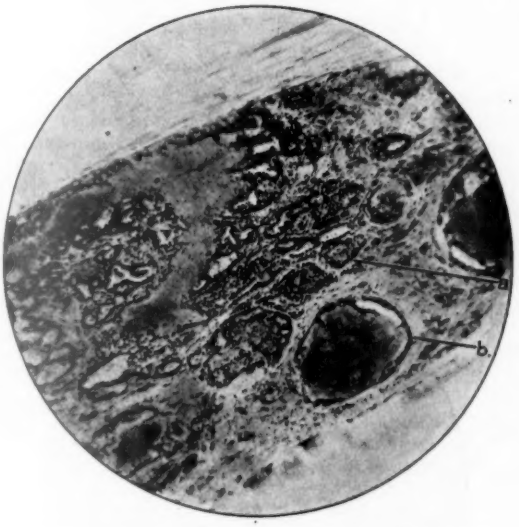


FIG. 4 (Case III).—a. Groups of carcinoma cells. b. Area of cell degeneration.

optic nerve and the dural sheath, and also through the sclera to the nasal side of the optic disc. Carcinoma cells are present at the site of excision through the optic nerve. Lymphocytic infiltration is present at the advancing edge of the neoplasm.

(IV) E. J., male, aged 63. Primary carcinoma in lung.

For three or four months had noticed specks before the left eye, and for one month had observed a "brown stain" in the left field of vision.

The eye was excised.

Macroscopic appearances (fig. 5).—Adjoining the optic disc in the lower nasal quadrant of the eye and arising from the choroid is a neoplasm measuring 5 by 2 mm., thicker at the central end and tapering at the periphery. The retina is lifted up over the swelling and there is a shallow detachment below the site of the neoplasm.

Microscopic appearances (fig. 6).—The neoplasm is a metastatic deposit of carcinoma composed of short columnar and cubical epithelial cells having an adeno-papillary arrangement. The stroma consists of thin connective tissue trabeculæ.

FIG. 5 (Case IV).—The metastatic deposit of carcinoma is in the choroid on the nasal side of the optic disc.

FIG. 6 (Case IV).—Shows the adeno-papilliferous arrangement of the carcinoma cells.

Areas of degeneration and lymphocytic infiltration are present. The chromatophores are distorted and a few thin-walled capillaries traverse the neoplasm. The outer layers of the retina are infiltrated at the edge of the optic disc.

(V) Mrs. W., aged 43. Primary carcinoma in lung and bronchus.

January, 1931.—Defective vision. Less than $\frac{6}{60}$. In the lower temporal quadrant of the globe there was a large mass in the choroid, the surface of which was irregular. The eye was excised on account of pain.

Macroscopic appearances.—The neoplasm is situated in the lower temporal quadrant of the choroid, between the optic disc and the equator. The antero-posterior diameter is 12·5 mm. and its thickness varies from 0·5 to 2·5 mm. The overlying retina is detached and rucked up.

Microscopic appearances.—The neoplasm is composed of malignant epithelial cells which have an adeno-papilliferous arrangement. Some of the cells are short cubical and are heaped up in irregular clumps. Mitotic figures, areas of cell degeneration and lymphocytic infiltration of the trabeculated connective tissue stroma are other features. Bruch's membrane is stretched over the neoplasm and degenerate and the retinal pigment epithelial cells are shed into the sub-retinal fluid. The sclera is infiltrated at the base of the neoplasm and some carcinoma cells are present between the lamellæ. The retina over the neoplasm is detached and undergoing degenerative changes. The optic nerve shows atrophic changes.

Pathological diagnosis.—Metastatic papillary adeno-carcinoma of the choroid.

In June, 1931, the patient died.

(VI) Mr. W., aged 59. Primary carcinoma in bladder and prostate.

December, 1931.—The left eye showed clinical evidence of acute secondary glaucoma and the presence of buff-coloured nodules on the iris, which were believed to be of a malignant character. A primary neoplasm was situated in the perineum. The patient died and the left eye was removed post mortem.

Macroscopic appearances (fig. 7).—The anterior chamber is shallow, a white mass is adherent to the anterior surface of the iris. The retina is detached. Arising from

FIG. 7 (Case VI).—a. Metastasis of carcinoma in the choroid. b. Metastasis of carcinoma in the iris c. Detached retina.

the choroid is a neoplasm projecting forwards into the sub-retinal space. The cut surface presents irregular shaped islands of cells divided by connective tissue trabeculæ. Areas of hæmorrhage and degeneration are present.

Microscopic appearances.—The cornea is irregular in thickness, the substantia propia œdematous and Descemet's membrane rucked up. The iris and some organized exudate are adherent to the back of the cornea in its lower part.

The anterior chamber contains exudate, pigment deposits and the remains of leucocytes. In the twelve o'clock meridian on the iris there is a metastatic deposit of carcinoma composed of spheroidal cells in a tubulo-acinous arrangement in some places. The neoplasm is very cellular and the stroma sparse. Below this metastatic deposit there is an organized inflammatory membrane on the anterior surface of the iris. The remainder of the iris is atrophic. There is a complete posterior synechia and an organized pupillary membrane. The lens is swollen and vacuolated and organized exudate is present in the circum-lental space. Cyclitis is evident.

Arising from the choroid in the posterior third of the globe is a neoplasm composed of spheroidal cells, some of which have a tubulo-acinous arrangement. Areas of degeneration and mucoid changes are present and the stroma is sparse. The sclera is infiltrated but there is no evidence of extra-ocular extension. The retina is detached and degenerate and the sub-retinal fluid contains exudate, deposits of pigment and red blood-corpuscles.

The PRESIDENT said that he was particularly interested in the case of metastases from the lung, because, several years ago, he had made sections from a case in which the metastatic choroidal tumour presented exactly similar appearances; no report of that case had been published. There had been some doubt in his mind as to the origin of the tumour.

Section of Tropical Diseases and Parasitology.

President—H. S. STANNUS, M.D.

[*March* 2, 1933.]

DISCUSSION ON THE DIAGNOSIS OF CHRONIC DIARRHŒAS.

Dr. Robert Hutchison : Chronic diarrhœa is a symptom and not a disease, and diagnosis has usually to be made by exclusion. Some form of classification is therefore necessary and the following is suggested :—

(1) *Gastrogenic*, due to achlorhydria or to achylia. Why these conditions sometimes lead to diarrhœa is not understood ; it is apparently not a question of " gastric " hurry, or of the absence of the antiseptic action of normal gastric juice. The stools are loose and may occur either after meals or between them ; they contain undigested connective tissue.

(2) *Fatty*, in which the stools contain undigested fat. This variety includes the rare condition, congenital steatorrhœa, in which liquid fat is present; pancreatic diarrhœa, due to failure of pancreatic secretion to enter the bowel and in which unsplit fat is present in excess, as well as undigested muscle fibres ; cœliac disease, met with in children and occasionally in adults (so-called non-tropical sprue) and due apparently to a failure of absorption of fats, split fat being present in excess ; and, lastly, rare cases in which blocking of lacteals (e.g., in tabes mesenterica) also interferes with fat absorption.

(3) *Enteritis*—a catarrh of the small intestines, which may arise from various causes, e.g., gross errors of diet, alcoholism, tuberculosis, or uræmia (eliminative diarrhœa) but sometimes from unknown causes. The stools are fluid and on microscopic examination are found to contain bile-stained mucus. They may be offensive, from decomposition of proteins (putrefactive diarrhœa), or sour and bubbling, from fermentation of carbohydrates (fermentative diarrhœa).

(4) *Colonic.*—In this large group the seat of the trouble is in the colon. One may distinguish the following variations : (*a*) catarrhal—a simple catarrh of the bowel—in which the motions tend to occur in the early part of the day (morning diarrhœa) : there is often a history of a previous attack of acute colitis, perhaps years ago ; (*b*) ulcerative, due to ulcers in the colon—these may be either dysenteric or non-dysenteric (ulcerative colitis) ; (*c*) obstructive, in which the diarrhœa occurs as an " overflow "—the obstruction may be due simply to an accumulation of scybala (spurious diarrhœa) or to non-malignant (e.g., tuberculous) or, far more commonly, malignant tumours.

In all cases of colonic diarrhœa the stools are apt to contain visible mucus, and, if ulceration is present, blood or pus. Tenesmus is also frequent. The general nutrition, however, suffers less than in cases of enteritis.

(5) *Neurogenic.*—In this group the bowel mechanism is alone at fault. One may distinguish as varieties : (*a*) Reflex, an exaggerated reflex excitability of the bowel—if the motions occur immediately on the taking of food the diarrhœa is sometimes spoken of as " lienteric " ; (*b*) emotional or psychogenic, when fear, anxiety, and other emotional states " fire off " the bowel.

The differential diagnosis of these varieties involves the taking of a careful history, thorough physical examination both abdominal and general, an inspection of the stools by both the naked eye and the microscope, and a digital exploration of the rectum. In some cases it may also be necessary to use the sigmoidoscope, to give a test meal, and to have a chemical analysis of the motions for fat, etc. An X-ray examination after a barium enema is often helpful. In spite of the most careful investigation, however, the cause of the diarrhœa frequently remains unexplained.

It must also be remembered that any given case may really belong to more than one of the above groups. In particular, it is very common for a neurogenic element to be superadded in any case of chronic diarrhœa, no matter what is its primary cause.

Dr. P. H. Manson-Bahr: Although much is still nebulous in this intricate subject, we are perhaps in a better position to regard the whole of it in perspective; I will therefore endeavour to confine my remarks as much as possible to differential diagnosis, for this is all important. In no other branch of medicine is it so essential, for accuracy in diagnosis is a paramount necessity for effective treatment.

Firstly, in dealing with dysenteries, it is necessary to refer to intestinal amœbiasis. There is too great a tendency to ascribe the majority of tropical diarrhœas to this cause and to give emetine unhesitatingly in every case in which an adequate explanation cannot be immediately given. I am totally opposed to this method, which excludes the possibility of the case being one of a chronic bacillary dysentery or, it may be, the aftermath of that infection, for I am convinced that chronic bacillary dysentery is a much commoner disease than is popularly supposed to be the case. The difficulty lies with differential diagnosis; there may be so little to go upon. In this differentiation a combination of clinical experience and a specialized pathological knowledge appears to be essential in order to explain and appreciate the underlying problems.

The patient who is suffering from chronic bacillary dysentery is usually a very sick man; the emaciation may be extreme; there may be "flare-ups," with pyrexial attacks and the passing of blood and mucus. Usually, however, the outstanding features are chronic diarrhœa and emaciation. The only certain method of making a diagnosis is by sigmoidoscopic examination (see Table I).

DIFFERENTIAL TABLE.—I.

Chronic Amœbic Dysentery.	*Chronic Bacillary Dysentery.*
Onset.—Insidious.	Acute at first, subsequently running a relapsing course.
Pyrexia.—Absent.	Usually "low" irregular fever.
Course.—very prolonged.	Chronic, five or six years.
Complications.—Hepatitis, liver abscess, perforation of gut, intestinal hæmorrhage.	Polyarthritis.
Emaciation.—Rare.	Extreme.
Blood.—Usually no anæmia.	Secondary anæmia usual, may be extreme.
Leucocytes.—Usually moderate leucocytosis.	No leucocytosis. Serum agglutination: usually agglutinates Shiga or Flexner.
Signs—Local tenderness and infiltration over course of large intestine.	Usually no tenderness or infiltration. Sigmoid may be spastic.
Pathology.—Local ulcers confined to the large intestine.	Chronic serpiginous ulceration or localized formation of granulation tissue.
Stools.—With flakes of blood and mucus. Copious in amount and very offensive.	Chronic diarrhœic stools with undigested particles. Occasionally blood and mucus in large amounts. Decomposing and very offensive.
Microscopic.—*E. histolytica* cysts; it may be active amœba with ingested red cells. Charcot-Leyden crystals present.	Pus cells and occasionally red cells. Usually clumps of intestinal epithelial cells.
Sigmoidoscopic.—Lax, with redundant mucous membranes; usually small ulcerations with hæmorrhagic margins visible.	Bleeding. Granulation tissue with rigidity of bowel wall, usually no ulcers visible.
Sequela.—Appendicitis.	Localized stenosis of bowel.

The treatment of chronic bacillary dysentery is a very difficult matter. Obviously if the condition is treated as one of amœbic disease, with emetine, the patient is made very much worse. I am thoroughly convinced now that in resistant cases the only rational treatment is surgical interference and the washing out of the bowel, as in idiopathic ulcerative colitis.

The question whether ulcerative colitis occurs in the tropics in the same proportion as it does in this country is a debatable one. From my experience I have no hesitation in saying that true cases of this disease arise in tropical residents in the same manner as they do in temperate countries. I consider it a disease which is essentially distinct from bacillary dysentery. In my opinion it is a constitutional disease in which the toxins are excreted through the mucous membrane of the large intestine, and that there is no evidence to show that it is in any way an infectious disease. It occurs sporadically and is apparently more frequent in women than it is in men.

The clinical features are the rapid onset with fever, the profuse sweats, the intense toxæmia of the patient, the rapidly developing anæmia and its rapidly fatal course. There is another feature in which it differs from chronic bacillary dysentery in its liability to spontaneous recovery. It is moreover often complicated by perirectal abscesses and stricture of the bowel. I cannot agree with A. F. Hurst, who considers that it may be associated with an infection of one or other of the dysentery bacilli, neither have I been able to obtain any evidence that the course of the disease is in any way affected by the administration of large doses of anti-dysenteric serum. Nor can I agree entirely with Bargen that it is due to a special diplococcus, and in the twelve cases or thereabouts which I have treated I have obtained little evidence that Bargen's serum has any effect upon the course of the disease. The diagnosis in ulcerative colitis can best be made also by signoidoscopic examination, and I consider that the appearances are sufficiently distinctive and can be differentiated from those of chronic bacillary dysentery.

In idiopathic ulcerative colitis, the mucous membrane is congested and has a plush-like appearance; it bleeds wherever the surface is bruised by the instrument or by means of a swab. In its fully developed stages there may be stripping of the mucous membrane, and naturally the appearances vary according to the length of time that the disease has lasted; in effect it resembles in this respect the ulceration that one sees in uræmia, and also in mercurial poisoning, and very much resembles the end-results of bacillary dysentery (see Table II).

DIFFERENTIAL TABLE.—II.

Chronic Bacillary Dysentery.	*Idiopathic Ulcerative Colitis.*
Onset.—May be acute at first; often running a relapsing course. Evidence of a definite infection.	Sudden, with sweats. Occurrence sporadic. No evidence of infection.
Pyrexia.—Irregular pyrexia, but usually apyrexial.	Usually intermittent, pyrexia in bouts.
Course.—Chronic.	May be acute or chronic.
Complications.—Polyarthritis, parotitis.	Polyarthritis, polyposis of colon, stricture nephrosis, endocarditis, septicæmia, perirectal abscess, cutaneous ulcers, splenomegaly.
Blood.—No anæmia at onset; eventually anæmia. Serum usually agglutinates Shiga and Flexner bacillus.	Very severe secondary anæmia from onset. No agglutination.
Signs.—Usually no tenderness over bowel. Defæcation very painful.	Great tenderness. Defæcation usually painless.
Pathology.—Serpiginous ulceration of large intestine, localized formation of granulation tissue.	Commences in rectum; degree of ulceration varies greatly in different stages of the disease.
Microscopic.—Chronic diarrhœic stool with undigested particles, occasionally blood and mucus.	Red blood cells in clumps. Disentegrating pus cells and intestinal epithelial cells.
Sigmoidoscopic.—Bleeding granulation tissue with rigidity of bowel wall.	Granular, diffuse inflammation of rectal wall, with narrowing of the lumen. Miliary abscesses and ulcers.
Sequelæ.—Localized stenosis of bowel. *Bacillus coli* complications.	Generalized stenosis of bowel, perforation, hæmorrhage, endocarditis and septicæmia.

As regards treatment, the best results that I have yet obtained have been by appendicostomy and irrigation of the large intestine.

Membranous colitis.—This, I believe, is also a distinct clinical entity, and it occurs quite commonly in the tropics, where it has nothing whatever to do with infection with bacillery dysentery, although it is frequently confused with this condition. I have had at least three bad cases hailing from India and Malaya. In this condition there is an exfoliation of the mucous membrane of extensive tracts of the large intestine, and complete casts of the bowel may in this manner be passed; together with this sloughing there is the passage of blood and mucus in the stools.

It has been my experience that this disease also is commoner in women than in men. I regret that I cannot offer any suggestion as to its efficient treatment, for it nearly always recurs, and patients thus afflicted are well advised to keep out of the tropics altogether.

Mucous colitis.—I consider that this disease remains an absolute enigma, or, as Bastedo has expressed it, "there is much difference of opinion about its character, and no agreement about its ætiology." Nevertheless it is extraordinarily common in tropical practice, and I go so far as to say that it is more frequent in its manifestations in tropical residents than in almost any other class of individual. It apparently is common too amongst native races, especially when partially educated and Westernized. I consider that there is no evidence for regarding it in any way as an infection, but subscribe to the idea that it is best explicable as a secretory neurosis of the bowel wall. It is nevertheless a common sequel to both amœbic and bacillary dysenteries, and has therefore often been regarded as being evidence that the original infection has not been cured. This is an attitude of mind from which the tropical practitioner appears to have difficulty in dissociating himself. Many of the so-called incurable cases of amœbic dysentery are really outstanding examples of mucous colitis, and I consider it worse than useless to continue to treat them with emetine and other irritating drugs as if they could have some specific action upon this mysterious complaint.

The differential diagnosis from chronic amœbic dysentery can be made by stool examination. In mucous colitis flakes of mucus will be found under the microscope and will be found to contain the characteristic mucus-secreting cells. Should there be any doubt, sigmoidoscopic examination will usually settle the matter. In mucous colitis it is easy to observe the strings of ropy mucus which are being secreted from the bowel wall, and very often the whole intestinal lumen is blocked with this gelatinous substance.

As regards treatment: I must agree with the prevailing medical opinion that although the immediate symptoms may be relieved by bowel lavage, this has no permanent effect upon the course of the illness. I consider, too, that patients suffering from this affection are best advised to live in a temperate climate. The mysterious condition known as "polyposis" of the bowel may occur as a sequela of chronic bacillary dysentery, or may arise *de novo*. My experience has been limited to three or four cases, and I find that malignant changes are liable to occur in the polypi themselves.

Surgical polypus is frequently confused with the two main forms of dysentery, especially when it occurs in small children; the possibility of a polypus being responsible for the passage of blood and mucus in the stools must never be lost sight of in cases where blood and mucus is passed at the end of evacuation, and in cases where there are no other constitutional disturbances, and also in those cases which have been subjected without success to the various forms of treatment adopted for dysentery.

From microscopic examination of the exudate, I think it is possible to suspect the existence of a polypus, and this of course can be confirmed by sigmoidoscopic examination.

Tuberculosis of the large intestine is comparatively common in tropical practice. I have seen four or five examples of this condition in which the tubercle bacilli have been demonstrated in ragged ulcers seen through the sigmoidoscope, and there is some reason to believe that this occurs as a sequela sometimes to chronic bacillary dysentery.

Syphilitic ulceration of the large bowel may sometimes be encountered in native races, and may simulate dysentery very closely. The diagnosis again is made by sigmoidoscope and by the recognition of other stigmata of the disease.

Malignant disease of the large intestine has always to be borne in mind. It occurs as frequently in the tropics as it does elsewhere, and there is some reason to believe, as Willmore has shown, that malignant changes are specially liable to occur on the base of chronic amœbic ulcers, so that it has been my experience to find malignant disease of the rectum associated with active amœbic dysentery.

Stercoral ulceration of the large intestine may give rise to blood and mucus in the stools and to the suspicion of a chronic dysentery. I have encountered one such case in a woman suffering from myxœdema, who had been invalided from India on account of chronic dysentery with œdema. The constipation was extreme. This case responded remarkably to thyroid treatment, and the ulcers healed up in a very remarkable manner.

There are three other forms of parasitic diarrhœa to which I must refer. There is bilharzial dysentery, which is common in Africa and in South America. The eggs of the parasite *Bilharzia mansoni* are passed in the fæces and can be recognized by microscopic examination. The lesions consist of ulcers and polypi of the large bowel and can easily be recognized by sigmoidoscopic examination. A further method of diagnosis is by the removal of a portion of the growth and examination under the microscope. Fairley has devised two confirmatory tests: intradermal reaction and the complement-deviation test, which can be applied in a doubtful case.

Then there are the dysenteric symptoms associated with kala-azar, due to ulceration and polypoid formation of the large intestine by infection of the *Leishmania donovani*. As shown by Shortt and his collaborators, if the proper technique is adopted the parasites can be demonstrated in the fæces. Of course in this disease there are other obvious stigmata to guide one.

Chronic diarrhœa is extremely common in gross infections of the sub-tertian malaria parasite (*Plasmodium falciparum*); sometimes actual blood is present. I have often seen these cases diagnosed as one or other of the dysenteries, and I have on occasions been able to demonstrate the malaria parasite in blood passed per rectum. The pathology of the condition is due to the gross infection of the intestinal capillaries with this organism. The treatment naturally should be directed towards extirpating the malarial infection.

Flagellate diarrhœa.—The presence of intestinal flagellates is frequently verified in the chronic tropical diarrhœas, and it does not necessarily indicate that they are the source of the trouble. They may be concomitants, and may be flourishing like fish in some nutritive stream. If any one of them has a claim to pathogenicity, I think it is the *Giardia intestinalis*, more familiarly known as *Lamblia*. I regard the lamblia syndrome as typical: the passage of much flatus, accompanied by a peculiar light-coloured and undigested stool, in which these parasites swarm. There is also some evidence that in lambliasis there is a heavy infection of the gall bladder. Although intensive treatment with yatren, given by the mouth and by the rectum, has a most beneficial action in these cases, I cannot say truthfully that it entirely eradicates the infection. I believe, too, that when the acute stage is passed, tolerance is elaborated against this infection, so that people in normal health continue to pass the cysts in their fæces.

Sprue.—Finally there is sprue, and the conditions which so closely resemble it. There should be no difficulty in diagnosing an outstanding case of sprue, for there

is nothing quite like it in the whole of medicine. By this I mean that the patient exhibits the characteristic tongue, the flatulent abdomen, the large white and frothy stools and the accompanying usually severe anæmia. Emaciation is always a feature of this disease; but in quite 50 per cent. of the cases the intestinal symptoms are present without the involvement of the tongue and of the mouth, and it is with these cases that difficulty is likely to arise, for they are so often mistaken for chronic amœbic dysentery. I cannot conceive any treatment more calculated to upset and seriously damage a patient suffering from sprue than the methods usually employed in curing amœbic dysentery. Too often sprue is confused with pernicious anæmia, and in my experience true pernicious anæmia is also found in tropical residents; that means to say the development of a severe primary anæmia without the necessary involvement of the gastro-intestine, nor is there usually in these cases any involvement of the mouth or tongue. On the other hand, sprue is liable to be confused with pancreatitis in adults, and undoubtedly inflammation of the pancreas is as frequent in the tropics as it is elsewhere. The differential points of diagnosis immediately arise to the mind. Cœliac disease is commonly found in European children brought up in the tropics, especially in India and Malaya. I am frequently seeing these patients, in whom there is always to be noted a certain lack of bodily and mental development, and who are suspected of having sprue. I am convinced that sprue does not occur in children, and they respond almost immediately to a fat-free dietary. The change in the mental attitude of these children is remarkable when placed upon a proper dietary, and it is probable that the existence of this unsuspected disease accounts for the idiosyncrasies and the unmanageable dispositions of many European children brought up in the tropics.

Then there is cœliac disease as it occurs in adults, which is confused with sprue occurring in the temperate countries, and which has been so well described by Drs. Bennett, Hunter, and Vaughan in the *Quarterly Journal of Medicine*, 1932, xxv (N.S. 1), 603.

Quite a sensation has been caused by the description of these idiopathic steatorrhœas in adults by Herr Thaysen as non-tropical sprue. It is freely admitted that much more research requires to be done before it is possible to admit that there are cases of true sprue originating outside the tropics.

Mr. Lionel E. C. Norbury: *The Surgical Aspect, with Special Reference to Ulcerative Colitis.* Diarrhœa may be true or "spurious." It is with the latter that the surgeon is chiefly concerned.

With "spurious" diarrhœa, the patient has the feeling that his bowels are going to be opened, but all that is passed is a greater or lesser quantity of mucus—blood and pus, perhaps with an admixture of fæcal matter. This may happen many times a day. The causative factor of such symptoms may be simple or difficult to determine, but needless to say a correct diagnosis is all important.

The more common lesions which the surgeon may be called upon to diagnose and treat are ulcerative colitis and proctitis and their sequelæ; tumours of the colon; diverticulitis of the colon.

Ulcerative colitis, as I understand it, is the name given to a definite disease, with more or less well-defined symptoms and characteristic pathological appearances. It does not include every variety of ulceration of the colon.

Symptoms.—The chief symptoms are frequent motions, with or without pain, with the passage of blood, mucus and pus. Sloughs are also present. Food passes through the alimentary tract with great rapidity and so is undigested, the patient rapidly losing weight. Tenesmus is unusual, except with ulceration in the lower rectum.

Etiology.—Ulcerative colitis is a disease of early adult life. The sexes are said to be equally affected, although in cases treated at St. Mark's Hospital the disease

appears to be more frequent in women. It was formerly considered to be of dysenteric origin, owing to the finding of Flexner's dysentery bacilli in a case and because of the results of treatment by anti-dysenteric serum, as described by Hurst. This experience of isolating dysentery bacilli from the stools in cases of ulcerative colitis must be very exceptional. In the vast majority of investigations both cultures and all serum tests have yielded negative results. The points against the dysenteric origin of ulcerative colitis are: (1) Absence of history. (2) Want of evidence of infectivity. Out of 693 cases of "chronic ulcerative colitis" examined at the Mayo Ciinic in only five instances did the disease affect more than one member of a family. Such an incidence might occur in any infection, and is a strong argument against a contagious origin. (3) Failure to isolate the bacillus from the stools. At St. Mark's Hospital, as a routine, cultures have been made from the stools with entirely negative results. Incidentally, during the past ten years there have been three cases of ulcerative colitis which proved to be amœbic dysentery. (4) Failure of patient's serum to agglutinate various strains of the bacillus: In none of the cases investigated at St. Mark's Hospital has the patient's serum produced significant agglutination of Flexner's or Shiga's dysentery bacilli. Again, a course of anti-dysenteric serum has had no beneficial effect in the cases so treated.

Many organisms have been isolated from the stools in cases of ulcerative colitis, those which have received most attention being streptococci, especially Bargen's diplococcus, which is regarded by most bacteriologists as a variant of *Streptococcus fæcalis*.

Pathological appearances as seen with the sigmoidoscope.—These vary considerably. In the early stages, œdema of the mucous membrane is present with multiple vascular granular areas. Later on, definite ulceration of the mucous membrane occurs. The ulcers may be small or punched out, or may run into each other, forming large irregular areas covered by bleeding granulations. These tend to spread superficially, mucus adheres to the ulcers and yellow sloughs may be present. The edges of the ulcers are not undermined. Bands of swollen mucous membrane are present between the ulcers and may assume a polypoid appearance (the so-called "colitis polyposa"). Owing to the superficial nature of the ulcers very little scar tissue results as a rule and stricture formation is unusual. Ulceration, however, may spread more deeply, invading and even perforating the muscular layers, thickened peritoneum forming the base, which latter may also be perforated. The healing of such ulcers may be followed by stricture formation, simple or multiple, often involving considerable areas of the bowel. A number of such have been put on record. Bargen reports 59 cases of stricture of the rectum or colon in a series of 693 cases of ulcerative colitis at the Mayo Clinic, i.e., 8·5%. We have had several similar cases at St. Mark's Hospital. It is not uncommon for such strictures to form low down in the rectum.

In ulcerative colitis, the tendency is for the ulcers to be distributed in the form of three bands, corresponding to the longitudinal bands of muscle, with intervening areas of swollen and hypertrophied mucous membrane. In a large number of cases sigmoidoscopy shows raw bleeding surfaces with loss of epithelium, but with no characteristic ulceration.

In the early stages of bacillary dysentery there is general congestion of the mucous membrane—swelling of the solitary follicles and small ulcers resulting from the breaking down of these follicles.

In the early stages of ulcerative colitis there is congestion and œdema, and later on small ulcers which, however, do not arise in the solitary follicles. These run together forming irregular ulcers. The later appearances are very similar in both types. *Diagnosis*: This is suggested by the symptoms and is confirmed by sigmoidoscopy and the finding of blood and pus in the stools.

A careful examination of the stools is essential in the differential diagnosis of

ulcerative colitis from dysentery as shown by the presence or absence of pus, blood, etc.

A barium enema and X-ray examination may show a spastic and irritable condition of the colon.

The sigmoidoscope should be passed with great care in suspected cases of ulcerative colitis, owing to the danger of perforation and hæmorrhage.

Certain constitutional diseases may be complicated by ulcerative colitis, e.g., chronic nephritis. Without a routine examination one may easily be misled in one's diagnosis, as is illustrated by the following case of a man, aged 55, suffering from chronic nephritis. About six months previous to my examination he had an acute exacerbation, with signs of cardiac failure. For five months the motions had been loose, and had contained large quantities of blood and mucus.

I diagnosed the condition as probably due to ulcerative colitis, complicating chronic nephritis.

Sigmoidoscopy showed, however, a malignant growth just beyond the recto-sigmoidal junction, thus illustrating the importance of a sigmoidoscopic examination. I well remember a physician once stating at a discussion on ulcerative colitis that he would be quite prepared to diagnose such a condition on the symptoms alone without the aid of the sigmoidoscope. In my opinion such an attitude of mind will sooner or later lead to an error in diagnosis and a carcinoma will be missed.

Achlorhydria has been demonstrated in certain cases of ulcerative colitis, both in this country and in America. I have seen improvement result both in the local and general condition after the administration of dilute hydrochloric acid by the mouth.

A deficiency of calcium in the blood has also been suggested as a causative factor in ulcerative colitis, similar to that present in other forms of ulceration, e.g., varicose ulcers, and, arguing on these lines, parathyroid extract and calcium therapy have been employed, but, in my experience, with little benefit.

It is important from the point of view of treatment to differentiate between ulcerative proctitis, which may be present without any involvement of the colon, and ulcerative colitis, which may be present without any involvement of the rectum proper.

More commonly ulcerative colitis and proctitis co-exist. The following case illustrates these points:—

A woman, aged 26, was admitted to St. Mark's Hospital complaining of passing large quantities of blood per rectum during the previous two months. Sigmoidoscopy showed much œdema of the mucous membrane of the pelvic colon, which was very hyperæmic and oozing blood, mucus and pus. Sloughs were also present. The rectal mucous membrane was almost unaffected. There was decided tenderness along the line of the colon, especially the pelvic colon. The patient was admitted to hospital. She had several severe hæmorrhages. Appendicostomy was performed with subsequent irrigation of the bowel. The condition, although critical for a time, responded to treatment, and she improved considerably for many months, but ultimately had a severe hæmorrhage and died.

In contrast, I would mention a case of a woman, aged 41, in whom the lesions were confined to the rectum proper, as shown by sigmoidoscopy.

Proctitis.—As already mentioned ulcerative proctitis may be associated with a similar condition of the colon, or may exist alone. Symptoms of "spurious" diarrhœa, with the passage of blood, mucus and pus, are usually present, and often accompanied by tenesmus. Any variety of proctitis may cause similar symptoms and may be followed by stricture formation. In such a case, especially if the stricture is low down in the rectum, pipe-stem motions may be noticed if the fæces are solid. More usually, however, symptoms of the accompanying ulceration are in evidence, namely, bleeding and discharge, often with alternating diarrhœa and constipation.

Under this heading one must include:—

Radium proctitis, which may follow treatment for carcinoma of the cervix, or the use of interstitial radium in the treatment of carcinoma of the rectum. Sub-mucous infiltration follows, with the liability to stricture formation.

Proctitis and subsequent stricture formation may result from the injection of strong solutions of chemicals—in the treatment of piles, etc.—or may follow the peri-rectal injection of paraffin in the treatment of prolapse of the rectum.

Gonorrhœal proctitis.—This is stated to be the result of direct extension from the genital passage as a rule, and to be most commonly found in women. It may, however, occur in either sex. In recent cases the nature of the infection may be determined by direct smears. Stricture formation is very liable to follow, and in cases of long standing it may be impossible to demonstrate the gonococcus in the presence of chronic sepsis.

It is stated in one of the textbooks on surgery that "the commonest cause of non-malignant stricture of the rectum is a chronic pyogenic infection, in most cases of gonococcal origin. The proportion of syphilitic cases has been exaggerated on account of the tendency to attribute to syphilis all strictures in which no definite cause can be described."

Gummatous proctitis with resulting stricture formation may undoubtedly occur, but here again it is difficult to be certain of the causative factor. A positive Wassermann reaction may be present, in certain cases; on the other hand, a gummatous proctitis + sepsis may result in a fibrous stricture and the Wassermann reaction be negative as a result of previous anti-syphilitic treatment.

Such a fibrous stricture, whether the result of chronic sepsis alone or in association with a venereal infection, may be single or multiple, annular, funnel-shaped, or irregular. It usually affects the lower three or four inches of the rectum, including the anal margin, and may reach as high as the pelvic colon.

Ulceration is usually present above the stricture, but may also be below, There is no ulceration of the actual lining membrane of the stricture. Here the ordinary cylindrical type of epithelium has been replaced by a pavement epithelium.

The stricture involves the whole circumference of the bowel and is characterized by bands of indurated and fibrotic muscle, between which are pockets, from the bottom of which fistulous tracks may lead to the surface in the anal region or open into the vagina. The extreme narrowing occurs at several points and will often prevent the passage of even a small bougie. One characteristic feature is the presence of hard polypoid growths below the stricture, a condition which has been said by certain authorities to be typical of a "gonococcal infection."

In old-standing cases, polypi may form immediately above the stricture. These may develop long-pedicles and project through the stricture. The bowel above the stricture is dilated and the mucous membrane catarrhal or ulcerated. The bowel below is often ballooned.

Age, 20 to 40 years; sex, usually female.

The possibility of these so-called gonococcal and syphilitic strictures being due to an infection with the virus which is responsible for the condition known as "lymphogranuloma inguinale," must be borne in mind.

Dr. Stannus, in his presidential address in October 1932, drew attention to the possible causal relationship between this new venereal disease and inflammatory stricture of the rectum.

Symptoms.—Increasing muco-purulent and blood-stained discharge; a feeling of fullness and of "something in the rectum"; frequent and ineffectual action of the bowels.

Tuberculous proctitis is very uncommon, and so a tuberculous stricture of the rectum is a rare occurrence; strictures are more common in the colon, chiefly cæcum.

Tumours of the rectum and colon.—Certain "simple" tumours may give rise to muco-purulent discharges and symptoms of spurious diarrhœa, e.g., villous papillomata of the rectum.

Polyposis intestini may give rise to similar symptoms. It is a disease characterized by adenomatous proliferations of the intestinal mucous membrane.

Polyposis may affect the whole colon and rectum or only a portion of the large bowel. A similar condition may be present in the stomach and small intestine either alone or in association with polyposis of the large bowel. Polyposis intestini has a definite familial tendency of the Mendelian type. It is transmitted by both males and females, and either sex may suffer from the disease. The sexes are affected in about equal proportions. It is a disease of adolescence or early middle life, and there is a marked tendency for malignant transformation to occur. The stools in this condition contain blood and excess of mucus but no pus, thus distinguishing it from ulcerative colitis in its early stages.

Carcinoma of the rectum.—True or "spurious" diarrhœa is often a prominent symptom with such lesions. Attacks of constipation may alternate with those of diarrhœa. Diarrhœa that persists and is associated with a mucous discharge is strongly suggestive of malignant disease of the rectum or colon, especially the latter. The frequent and urgent desire to go to stool with the passage of a small quantity of mucus and fæces is highly suspicious of a growth low down in the rectum. Blood is often passed per rectum, sometimes in large quantities. Pain is usually absent, except in advanced cases or unless the growth involves the anal canal.

Carcinoma of the colon.—The symptoms vary to some extent, according to the position of the growth. Some 75% of cancers are on the left side and of the scirrhous type. The chief symptoms are those of increasing constipation, alternating with attacks of offensive diarrhœa, due to irritation of the bowel above the growth by scybala. The fæcal matter passed is mixed with blood and slime. Attacks of colic and abdominal distension are also features. Tumours involving the right half of the colon are of a different type pathologically, and so the symptoms differ. The growth is usually of the fungating type—without constricting the lumen. The prominent symptom is therefore diarrhœa, due to ulceration and irritation. A tumour may also be palpable.

Diagnosis.—With carcinoma of the rectum the growth is usually quite easily felt on digital examination. If, however, it is beyond the reach of the finger, sigmoidoscopy will clinch the diagnosis. If thought advisable, a small portion of growth may be removed by Bruning's forceps, via the sigmoidoscope, for microscopical examination.

X-ray investigations.—A barium enema and X-ray examination may be misleading in the diagnosis of carcinoma of the rectum or recto-sigmoidal region. I have seen several cases in which the diagnosis was missed owing to the negative X-ray report, and neglect to examine with the sigmoidoscope. It is obvious that a filling defect in the recto-sigmoidal region or lower pelvic colon may be masked by the presence of barium in the rectum itself.

The diagnosis of carcinoma of the colon may be confirmed by:—

(1) A palpable tumour; (2) a filling defect, as shown by radiography; (3) occult blood in the stools; (4) sigmoidoscopy in cases of tumours of the lower pelvic colon; (5) exploratory laparotomy.

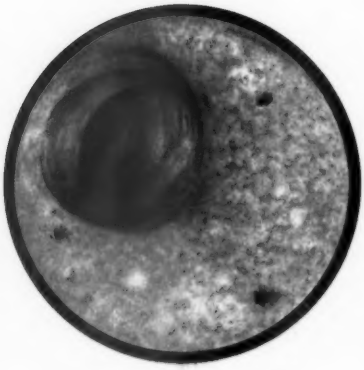
I operated recently on a case in which a filling defect of the pelvic colon was shown by radiography, and a diagnosis of probable carcinoma was made. An abdominal exploration, however, revealed a perforated diverticulum with a peri-colic abscess.

Diverticulosis of the colon may be responsible for symptoms of diarrhœa due to irritation from portions of fæces lodged in the diverticula. It may produce symptoms

1.

NORMAL RECTUM.

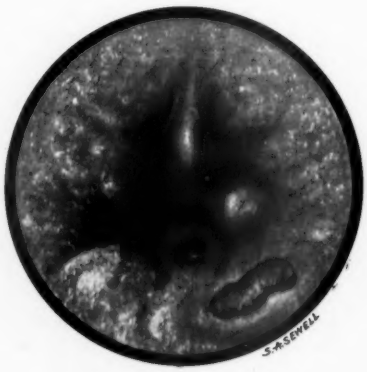
Branching blood-vessels apparent. Whitish-pink areas between vessels.



2.

GRANULAR PROCTO-COLITIS.

No ulceration. Elasticity of bowel preserved.



3.

ULCERATIVE PROCTO-COLITIS.

Deep ulcers—loss of dilatation of bowel. Granular polyps.

John Bale Sons & Danielsson Ltd London

4.

ULCERATIVE PROCTO-COLITIS.

Close-up view of ulceration showing exposure of circular muscle—and destruction of mucosa.

very similar to carcinoma. The descending and pelvic colon are the portions most often affected. Constipation is usual, due to obstruction from inflammatory tissue, but diarrhœa may also be present.

Irritability of the bladder with frequency of micturition is often an early symptom.

A mass may be felt on abdominal examination unless the patient is too well covered. Such a mass is usually situated in the left iliac region, and is tender to palpation.

The diagnosis is suggested by the symptoms and by the presence of a palpable tender mass. A barium enema and X-ray examination will show the diverticula, especially after evacuation, where they are depicted as flask-shaped processes filled with a residue of barium.

In advanced cases of diverticulitis, marked obstruction to the lumen of the bowel will be evidenced by the filling defect. Sigmoidoscopy may reveal the presence of diverticula if they are situated low down in the pelvic colon, but sigmoidoscopy in such cases is often difficult, owing to fixation of the bowel by inflammatory adhesions. It must be borne in mind that diverticulitis and carcinoma of the colon may be present at the same time.

I have only been able to refer briefly to the diagnosis of some of the more common surgical causes of diarrhœa ; the list is by no means complete.

I have to thank Dr. Cuthbert Dukes for kindly arranging a series of illustrative pathological specimens from St. Mark's Hospital.

Mr. E. T. C. Milligan : It is evident from the survey of reported discussions on non-tropical ulcerative colitis, and from the published results of the numerous forms of treatment, that clinical types are frequently confused. This is detrimental to the much-desired elucidation of the cause, and to the discovery of a specific remedy.

In this discussion then I will confine myself to the differentiation of *granular* procto-colitis from *ulcerative* procto-colitis. It is common knowledge that the rectum is involved in all cases in both types, and fortunately the appearance of the easily-examined mucous membrane of the rectum through the proctoscope is a true picture of the changes in the rest of the colon if involved. Nevertheless in the granular type the sigmoidoscope should always be employed to determine the extent of the lesion, for the rectum alone in this form may be involved (proctitis) and remain so for years without upward spread. Furthermore the prognosis is influenced by the extent of mucous membrane affected.

In the granular form, the appearance of the rectum or colon viewed through a proctoscope or sigmoidoscope is granular, vivid pink and moist. It easily bleeds with trauma, and the normal branched blood-vessels are no longer visible, shallow pitting may be present but deep ulceration of mucous membrane is absent. Discharge on the surface varies from a trace of blood to large quantities of pus, muco-pus and blood. Snippings taken for diagnosis or investigation and examined by Dr. Cuthbert Dukes show that the tubular glands, never totally destroyed at any point, are always present in part. The inter-glandular tissue is the site of acute inflammation with out-pouring of leucocytes. Sometimes organisms are seen but often not. The nature of the organisms would, we hoped, have helped us in our investigations. It is interesting to note that the ulcer left after snipping heals rapidly without scar formation. The absence of total destruction of tubular glands is a fundamental distinguishing feature of the granular type.

In ulcerative procto-colitis the whole thickness of the mucous membrane with its tubular glands is destroyed in localized areas. The resultant ulcers have irregular edges and expose the circular muscle. This deep ulceration is characteristic of the ulcerative type and is absent in the granular form. The intervening mucous membrane and submucosa is the site of acute inflammation with close collections of leucocytes. These myriads of unbroken and undrained abscesses give rise to the toxæmia, the distinguishing clinical feature of this form. Discharge in the bowel is

always purulent and profuse. The ulcerative type is rarely confined to the rectum alone but invades the colon as well. The deeply penetrating intensive inflammation with its products of lymph and cells destroys the elasticity of the bowel wall. The lumen therefore cannot easily be distended with air on examination and probably never is dilated with the fluid fæces present. Contracting spasm follows the ulceration. So all the factors are present for stricture formation associated with this type.

The elasticity of the bowel wall is unimpaired throughout the disease in the superficial granular form, so that it can be observed, with air distension on examination, to dilate and collapse. Stricture formation never occurs.

Defæcation is painful in the ulcerative variety. If instrumental examination is ever indicated in this form, it should be carried out under low spinal anæsthesia. Diagnosis can however confidently be made without sigmoidoscopy. These manipulations are painless in the granular form, where it is essential they should be employed. These facts reconcile the conflicting opinions of some surgeons and physicians on the necessity for sigmoidoscopic examination.

The end-results of inflammation are different in the two types. In the granular form resolution is always complete. The mucous lining and the bowel are restored to normal. This arresting fact has been observed where inflammation has lasted as long as six years. The patients can always be given the confident assurance that their bowel will ultimately return to the original condition. This ray of hope enables the mind to adjust itself to the alarming bloody discharges. In ulcerative procto-colitis the bowel will never return to normal. Fibrous tissue in varying amounts will repair the destroyed tubular glands and mucous membrane, giving rise to scars, perhaps distortions and strictures. Moreover a granulation polyposis may develop. The well-known X-ray appearances strikingly demonstrate these early and late changes in the ulcerative form, with loss of haustrations, narrowings and deformities. X-ray examinations, however, reveal a normal colon throughout the course of granular procto-colitis.

Before further differences of the two diseases are described, their superficial resemblances, which doubtless are the cause of confusion of thought to those who do not critically examine the bowel, may well be mentioned. Diarrhœa is present in both with alarming discharges of pus, and blood, but is very variable in degree. If the clinician himself relies on this symptom alone for diagnosis he will be unable to differentiate between the two conditions. The pathologist who is not alive to the distinction is but rarely able by examination of stools alone to separate the two diseases, although the discharges seen through the proctoscope are often characteristic of each disease.

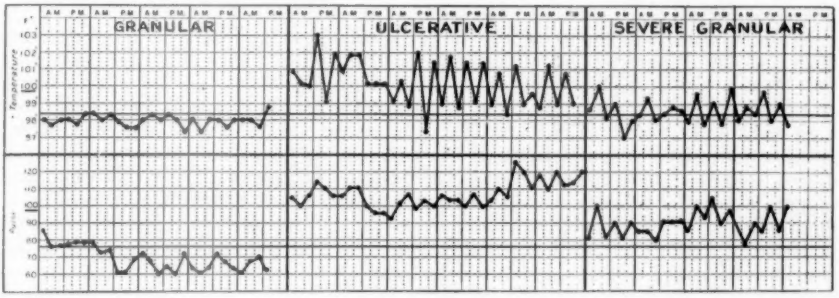
Granular procto-colitis is much more common than the ulcerative form. From cases under observation one would put the proportion as 15 to 1.

The difference in the pathology of the bowel is strikingly reflected in the condition of the patient. The clinical picture in ulcerative procto-colitis is unmistakable, it can be diagnosed with assurance even by those who cannot or prefer not to use a protoscope or sigmoidoscope in this disease. The clinical picture of granular procto-colitis is, however, not characteristic, and cannot be differentiated with certainty from that in carcinoma of the bowel or that in granular proctitis without sigmoidoscopic examination, which moreover in this condition, as we have already learned, is painless, and in the patient's best interests. Frequent motions are common to the last three mentioned conditions. The amount of blood and pus varies in each and in different types of each, but is not distinctive. In neither is there a distinctive diagnostic toxæmia. Clinical sense or folly reaches its worst when it would deprive such a sufferer of a diagnostic and prognostic sigmoidoscopic examination. Sad experience too often shows that to rely on digital and X-ray examination alone is to be fatally misled in diagnosis and prognosis.

The amount of toxæmia is the clinical distinguishing feature between the

ulcerative and granular types. The temperature and pulse chart in a patient with chronic diarrhœa is diagnostic in the ulcerative form. Temperature is raised above 100° F. and may reach 104° or more day after day. Pulse-rate is maintained over 100 beats per minute, 110-120 to 140 being registered.

In the granular form the toxæmia is usually not sufficient to raise the temperature above normal, occasionally it reaches 99° F. In severe forms the temperature does not go above 100° F. which it may reach occasionally. The pulse-rate never reaches beyond 100 beats per minute; between 70 and 96 is the usual rate. Indeed, one can almost visualize the proctoscopic appearance of the bowel in both forms from the pulse and temperature charts.



The difference in the patient's appearance is typical and striking, and is again the result of the toxæmia. Secondary anæmia, loss of weight, extreme emaciation in severe cases, dehydration, weakness which confines a patient to bed, are present in the ulcerative form. In the granular type anæmia is absent, except in hæmorrhagic inflammation; weight is fairly well maintained, white blood-count is not raised, the patient is robust, can get about and is able to fulfil daily duties if the diarrhœa and bleeding are not excessive. In most cases the bloody stools alarm, but do not harm, and this should be explained to the patient. The compelling desire to a fruitless stool, if always satisfied, and not resisted, will give great mental torture. If the consultant by examination of the rectum and colon can assure his patient that his disease is not cancer, but granular procto-colitis, which is not lethal, and although lasting weeks, months, or perhaps years, will ultimately disappear, the patient will adjust his life to his malady and symptoms, and preserve a sound mental attitude till the promised resolution occurs, carrying out the necessary treatment in the meantime.

Unhappily, when ulcerative procto-colitis is diagnosed, the course of the disease is seriously uncertain and the prognosis is indeed grave: death, prolonged invalidism and serious relapses, are not uncommon end-results.

Dr. Hamilton Fairley said that he had not envied the opening speakers, as there was so much that was questionable concerning our present knowledge of different forms of diarrhœa. The gastrogenic variety associated with achlorhydria was not common in tropical practice, though decreased acid secretion was often found accompanying diarrhœas originating in both the small or large bowel. Recently he had seen a case in which the condition had been erroneously treated for several years as sprue. The patient was a woman whose mother had died from sub-acute combined degeneration of the cord and anæmia. The daughter became perfectly well under hydrochloric acid therapy. He wondered whether pepsin was present in Dr. Hutchison's cases, i.e., whether the achlorhydria was a true achylia, and also whether the rate of passage of food through the intestine was greatly accelerated.

Much remained to be learned concerning the diarrhœas originating in the small bowel. No mention had been made of the interesting group associated with fistulæ of the small intestine like gastro-jejuno-colic fistula which had recently been shown at the Hospital for Tropical Diseases to be associated with megalocytic anæmia and to simulate sprue. The steatorrhœas also constituted an interesting group. Both sprue and iodiopathic steatorrhœa (so-called non-tropical sprue) had a definite biochemical background; there was an increase in the total fæcal fat which was adequately split, and a decrease in the blood-calcium, while glucose-tolerance curves were low and often showed a delayed rise—findings indicating delayed absorption of fat, calcium, and glucose respectively. In pancreatic steatorrhœa, on the other hand, there was a high fæcal fat which was inadequately split, high glucose-tolerance curves, and possibly increased diastase in the blood and urine.

The so-called diarrhœas of the large bowel were associated with mucus, and often, as in dysenteric and ulcerative colitis, with blood and pus as well. Dr. Manson-Bahr, in his table of differential diagnosis between ulcerative colitis and chronic bacillary dysentery, had said that the former disease commenced with high fever and sweats. This, however, was by no means always the case; many cases of ulcerative colitis in England were afebrile at onset and many remained so during relapse. In tropical patients the history of true dysentery was, of course, helpful, especially if intermissions had never occurred, but the only sure method of distinguishing between idiopathic ulcerative colitis and chronic dysentery was the isolation of dysentery bacilli, preferably from material obtained by gently curetting the diseased bowel during sigmoidoscopy. Cultures from the stools generally were negative and this was where more research was required; even in India, Cunningham had only isolated dysentery organisms in 26% of his chronic cases. A post-dysenteric diarrhœa in which the bowel appeared normal on sigmoidoscopy was sometimes encountered, and in another group of cases of chronic diarrhœa originating in the tropics the onset was not typical of bacillary dysentery at all, though it was generally labelled as such by both the patient and his practitioner. Mr. Milligan's classification of idiopathic ulcerative colitis into, firstly, a colitis with definite macroscopic ulcers associated with high fever and X-ray evidence of disease and, secondly, an afebrile or mildly febrile granular procto-colitis with a negative skiagram was most important. Febrile cases, however, did occur in which the sigmoidoscopic picture was that of granulo-proctitis, in which the pelvic and ascending colon was of tubular type, showing complete loss of haustration on X-ray examination, yet which, despite this fact, were capable of complete recovery.

He, the speaker, had observed two sigmoidoscopic pictures which, so far as he was aware, had not been previously described. The first was the appearance of multiple white nodules in the mucosa, the size of a pin's head, which he had recently observed in a case of intestinal schistosomiasis; on curetting the nodules lateral-spined eggs were obtained. The lesions were similar to, though somewhat smaller than, the bilharzial pseudo-tubercles which he (the speaker) had described in 1920, in experimentally infected animals and in the bladder of man. The second condition was an amœbic proctitis analogous to that seen in experimentally infected kittens in which the rectal mucosa showed generalized involvement in contradistinction to the more usual focal amœbic ulcers with intervening healthy mucosa. He had recently demonstrated such a case to post-graduates as being probably the result of chronic bacillary dysentery, and on curetting the bowel had been surprised to find large vegetative forms of *E. histolytica*, motile, and containing ingested red corpuscles. In another similar case, seen about six months previously, complete recovery had ensued after combined emetine and yatren treatment, and the bowel gave a normal sigmoidoscopic picture within three weeks. No dysentery bacilli were cultured in either case nor did the sera of the patients show any agglutination reaction to the dysentery group of organisms.

Section of Urology.

President—HUGH LETT, C.B.E. F.R.C.S.

[*March* 23, 1933.]

Growths of the Testicle.

By ALEX. E. ROCHE, F.R.C.S.

ABSTRACT.—Description of three recent cases, including one late and one early case. Pathology and classification. Relation of growth to trauma, previous inflammation, incomplete descent. Clinical aspect. Diagnosis from hydrocele, hæmatocele, tubercle, syphilis. Prognosis. Treatment by orchidectomy, the radical operation, X-rays.

AT the end of 1932, within a period of five weeks I saw three cases of growths of the testicle—in two of which I removed the growths.

Having, therefore, taken that topic as the subject of this paper, I was at first taken aback on realizing that I could recall seeing only 11 cases in all of testicular neoplasm; but was soon consoled by the fact that they are rare lesions, constituting only 1 in 1,500 of surgical admittances to hospital.

Description of cases.—The first of these three cases was that of a healthy-looking youth aged 19, who came to me on November 26, 1932. For three days he had noticed swelling of the right testicle, associated not with any real pain, but with a feeling of discomfort on sitting. Three weeks previously, at football, he had received a blow on the scrotum. There was pain, which had gone by the next day, but no bruising. He was unable to say which testicle had been hit. There was no history or evidence of venereal disease, and there had been no cough, influenza, micturition symptoms, or recent mumps. As far as he knew, both testicles had previously been of the same size.

Abdominal examination was negative. The left testicle was rather small and flabby; the right one was a comparatively large, smooth, ovoid, opaque mass, about 2 by $1\frac{3}{4}$ in. in length and breadth, unattached to skin, and feeling heavy and solid, except in front and above, where it felt elastic. There was only a faint trace of differentiation between the body of the testicle and the epididymis, both being apparently involved in the swelling. Testicular sensation was present and perhaps slightly enhanced. The right spermatic cord was a little thickened, but contained no nodules. Rectal examination was negative, and the urine clear. Subsequent microscopic and bacteriological examination confirmed its normality. But, even apart from such confirmation, the diagnosis of growth seemed justified, from the insidious onset of a heavy, painless, solid enlargement of the testicle, and a Wassermann test was unnecessary, in view of the patient's youth, history, and general appearance.

Hæmatocele, which was consistent with the history of trauma, the opacity of the swelling, and its antero-superior elasticity, was improbable as a complete

diagnosis, for there had been no bruising at the time of the blow, and no swelling had been noticed until two and a half weeks later.

As inflammations are much commoner than growths of the testicle, and as testicles are not lightly removed from youths of 19, especially on account of swellings which have been noticed for only three days, I suggested obtaining further advice. This confirmed my own opinion, and four days after first seeing the patient, I performed right orchidectomy at the internal ring through an inguinal incision, first cutting and tying the cord before gently dislocating the testicle upwards into the wound.

These points in technique may be important, since the rapidity with which metastases have sometimes followed orchidectomy are attributable to operative manipulation of the testicle, especially if the cord has not been first tied and cut. I have also heard the suggestion that the prognosis is worse in hospital than in private practice, owing to the increased clinical manipulation practised in the former.

Incision of the specimen after completion of the operation revealed a drachm or two of dark blood-stained fluid within the tunica vaginalis, while the knife cut antero-posteriorly, with a cartilaginous sensation, through an encapsuled central growth, surrounded by a rim of healthy testicular tissue, about $\frac{1}{4}$ in. wide. A small postero-medial cut, however, showed that the growth had reached the testicular tunics, but its capsule was not infiltrated. The epididymis was not involved. Professor Kettle reported that the growth was a characteristic teratoma, and consisted mostly of cartilage of a rather embryonic type, other constituents being squamous and columnar epithelium. He considered the growth potentially malignant.

The patient has since had two courses of deep X-ray therapy. He is an only child, and I am exceptionally interested to follow his case, as it must be rare to have the opportunity of diagnosing a testicular neoplasm three days after the first discovery of the swelling by an intelligent patient, and of performing orchidectomy within a week of the discovery.

The second patient, a porter, aged 41, seen at the West London Hospital on December 19, 1932, had been treated for a profuse gonococcal discharge, co-existent with a large right hydrocele. When I saw him, at the request of Mr. Endean, to whom I am indebted for permission to report the case, the patient was dyspnœic and extremely ill. The hydrocele had been tapped, and the residual swelling considered definitely malignant. On December 12 several cubic centimetres of blood-stained thickish fluid had been removed from the right side of the chest, where there was extensive dullness behind, and, three days later, 25 oz. of almost pure blood had been aspirated.

The right testicle was a large, hard, irregular mass, of about the size of a coconut, and epigastric fullness, resistance, and dullness were found on percussion. My notes of this case are incomplete, as it seemed futile and inhuman to worry the patient with questions or further examination. Twelve days later he died. There was no post-mortem examination.

The third patient, also referred to me by Mr. Endean, I saw on December 29. He was a labourer, aged 34, with an old venereal history, a negative Wassermann reaction, clear urine, and negative prostatic smears. He had a hard swelling of the left testis, mainly of the epididymis. Testicular sensation was absent posteriorly, but present anteriorly over the body, which could just be felt. The left spermatic cord was visibly swollen in the inguinal canal.

In spite of a history of previous swellings of the left testicle, which had subsided, and in spite of the swelling appearing to be mainly of the epididymis, the general fusing of this with the body, and the extreme hardness of the lump were, with clear urine and a negative Wassermann reaction, strongly suggestive of growth.

The patient, who wished shortly to get married, regarded his affected testicle as the better one, the other always having been small. But he was persuaded into

admittance to hospital, where re-examination confirmed the presence of a hard swelling, mainly of the posterior part of the testicle. A small groove was felt in front of the lower end of the large hard epididymis, but it was otherwise impossible to distinguish this from the body. The previously seen inguinal projection was found to be a translucent elastic swelling in the cord, fluctuation being obtained between this and the upper and front part of the scrotal swelling, which was here tender. Below was a hard opaque mass, over which the skin was adherent anteriorly and towards the lower end, over an area of the size of a halfpenny. The left vesicle was thought to be slightly enlarged, but the urine showed no pus or tubercle bacilli. Radiography of the chest was negative. The probability of neoplasm was maintained.

Through an inguino-scrotal incision, on January 16, 1933, the adherent skin and testicle were isolated, and a hydrocele was found. The lump below was hard and white, so orchidectomy was performed through apparently normal cord at the internal ring, just above the top of the inguinal extension of the unopened hydrocele. This was afterwards found to contain straw-coloured fluid. The lower part of the cavity of the tunica vaginalis was obliterated.

Incision of the removed testicle showed a large hard mass occupying the region of the epididymis and body, which were fused. In the upper and anterior part of the latter were the remains of normal-looking testicular tubules, probably responsible for the testicular sensation clinically elicited here. The mass contained yellow and red areas, and Dr. Elworthy reported that a thin rim of testis surrounded the growth, in which the epididymis appeared to be buried, and that it was a seminoma. The patient has since had a course of X-ray therapy.

Further questions show that, during treatment for gonorrhœa in 1925, he developed a painful red swelling of the left testicle, which never quite returned to normal, remaining harder and about half as large again as before. He was well till February, 1932, when the left testis again became red and swollen. This and the previous attack lasted about three weeks, and subsided with local applications. Matters were stationary till ten weeks before Christmas, 1932, when, never having had a blow there, he noticed gradual swelling of the left testicle, which was painful from the start. This attack, he said, was similar to the former, except that the swelling did not subside, became twice as big as in the previous attacks, and extended up to the groin.

I wish to thank Mr. Sydney MacDonald for kind permission to operate on this patient, and to report the case.

Pathology and classification.—The classification of testicular growths is confused and confusing. The old fibrocystic disease, based on naked-eye appearances, is now recognized to be a teratoma, containing representatives of the three germinal layers, while sarcoma, the former label for most malignant testicular growths, is now considered to furnish only 1 or 2% of growths of the testicle. What used to be called sarcoma is now called seminoma or spermatocytoma or spheroidal-celled carcinoma, and is supposed to arise from the seminiferous epithelium.

A good example of the mutability of pathological nomenclature is provided by the growth in Paget's classical case, described by him as a chondroma with secondary deposits in the lungs. Regarded, on re-examination, as a columnar-celled carcinoma with cartilaginous metaplasia in the stroma, it has, after further investigation, finally evolved into a teratoma. Nicholson's observation that both the primary and secondary growths were remarkably innocent in appearance reminds one that clinical and histological malignancy do not always run parallel.

As a provisional classification one may accept that of Dew, which fairly closely follows that of Chevassu and Nicholson. This recognizes two main, and about equally common, divisions of testicular growths—the teratoma and the seminoma. The third division (the sarcomata) represents only from 1 to 2% of testicular growths.

The so-called testicular dermoids, very much rarer than their ovarian counterparts, are the rarest of the teratomata. Appearing typically as cysts lined by squamous epithelium, and occupied by sebaceous matter and hair, their wall often contains highly differentiated structures, such as nerve tissue. Sir Bernard Spilsbury once told us of an officer whose testicular dermoid contained a pair of legs, or some such efforts at paternity. He was afterwards known as the pregnant major. According to Cairns, 84% of these growths appear in the first year of life and are benign. Unfortunately they are negligibly rare.

The undifferentiated teratomata form the great majority of teratomata, and one or other of the germinal layers may predominate and achieve malignancy, giving rise, in the case of epiblast, to the rare chorionepithelioma; in the case of mesoblast, again rarely, to sarcoma; and, in the case of hypoblast, to a teratogenous carcinoma. It is characteristic for one of the germinal layers to be so scantily represented, owing to the predominance of the other layers, as to be found, if at all, only after many sections have been cut. Owing to the possible suppression of two germinal layers, the question must arise whether, as Ewing suggests, all growths of the testicle are of teratogenous origin. But, perhaps, we may accept the roughly equal division into teratoma and carcinoma (or seminoma), since they have a different age-distribution, the average age of onset of the teratoma being 25, and of the seminoma 40. According to Dew, the seminoma also differs from the teratogenous carcinoma in having a longer history, and in metastasizing later, so that, although they both involve the lumbar lymph-nodes, generalization and visceral deposits are rare in the case of the seminoma.

The pathology of testicular growths, though of great interest, and of some importance from the points of view of prognosis and of reaction to radiotherapy, is not of much clinical help, since, apart from the clue of the patient's age, the clinician cannot usually differentiate the various testicular growths. For practical purposes, they are all potentially, when not actually, malignant, and the clinical problem is to establish the diagnosis of testicular growth, without specifying its variety.

Relation of neoplasm to incomplete descent.—With regard to the old question of the predisposing influence of imperfect descent on the development of a malignant growth in a testicle, the question is not: "Do malignant growths occur more frequently in incompletely descended, than in fully descended, testicles?" (They do not. Russell Howard found that, in 57 consecutive testicular growths, 85% of the affected testicles were fully descended.) The question is: "Is the proportion of incompletely descended neoplastic testicles to fully descended neoplastic testicles greater than the proportion of incompletely descended non-neoplastic testicles to fully descended non-neoplastic testicles?" The answer is, "Yes." In Russell Howard's series of 57 testicular growths, 15% of the testicles were incompletely descended; and in Odiorne and Simmons's series of 54 testicular growths, 11% were incompletely descended. Such figures are definitely higher than the 2% found by Hempel to be the proportion of ordinary incomplete descent among six million candidates for the Austrian army.

The conclusion appears warranted from these figures that an incompletely descended testicle is about five times more likely to become the seat of a growth than is a fully descended one, this increased liability being masked by the relative rarity of incomplete descent itself. The actual great rarity, however, of testicular growths enables the operation of orchidopexy to be usually performed with impunity as regards the risk of subsequent malignancy, although one may note that three examples of such a sequela have been reported.

Relation of neoplasm to trauma.—There was a definite history of trauma in the first of the three cases described, definite absence of trauma in the third, and no note as to it in the second. It is said to have occurred in nearly 50% of cases. The possibilities are as follows: Trauma might initiate a growth, as there is evidence that

it may in the case of bone sarcoma. While such a possibility cannot be denied in the case of the testicle, it is equally difficult to prove. It is hard to believe that the early teratoma of the testicle in the first case quoted in this paper could have arisen in three weeks, especially as cartilage is its main constituent.

The second possibility, that trauma may accelerate the development of a pre-existing growth, is very probable, though again difficult of demonstration.

Thirdly, by leading to palpation, trauma may draw attention to a pre-existing growth, without accelerating its development. Attention would be still more arrested should the trauma have added a hydrocele or hæmatocele to the growth.

Relation of neoplasm to inflammatory lesions.—As to previous inflammation, epididymo-orchitis is so common, and neoplasm so rare, that the supervention of the latter on the former, as in the third case described, must be regarded as a coincidence. Dew says that the great majority of malignant testicles give no history of venereal or other inflammation. Their possible co-existence, if not of ætiological significance, is of importance in diagnosis. In two of the forty cases of testicular neoplasm quoted by Dew a testicular swelling which proved to be a neoplasm arose in the course of acute gonorrhœa.

The lesson to be learnt from such cases, and from the second of my three cases, in which gonorrhœa co-existed with a neoplasm, and from the third case, in which neoplasm supervened after epididymitis, is that a supposedly inflammatory lesion, not subsiding within reasonable time, should be viewed with suspicion.

Diagnosis.—The diagnosis of neoplasm of the testis is made largely by exclusion, the important point being the usually painless and unaccountable onset of a solid, heavy swelling of the body of the testicle which cannot as a rule be differentiated from the epididymis. This apparent fusing, seen also in syphilis, is due either to flattening of the epididymis by the enlarged body, as in the first of the present three cases, or to actual involvement of the epididymis by growth, as in the third case, and almost certainly in the second.

Differential diagnosis.—The main differential diagnosis is from hydrocele, hæmatocele, tuberculosis, and syphilis. Two of the present series of growths were associated with hydrocele, and one with a small hæmatocele, and two of the other eight cases of neoplasm which I have seen were operated upon as supposed hæmatoceles. The association with hydrocele suggests caution in employing the injection treatment of hydrocele.

In diagnosing neoplasm from hæmatocele, palpation of the head of the epididymis has been considered important. It is said to be very often palpable in neoplasm, but not palpable in hæmatocele. This test, however, seems to me of little practical use, for in many cases the epididymis is involved by growth when the patient is first seen, and there is often fluid in the tunica vaginalis obscuring the epididymis. Even in the early case described, the head of the epididymis was not felt by me, although there was only a small quantity of hæmatocele fluid present. Indeed, I find it difficult to palpate the head of the epididymis when there is no testicular lesion, and the difficulty must be greater when the body of the testicle is enlarged by neoplasm. I should like to hear other opinions on this point.

Sometimes the diagnosis is achieved only during operation, or by naked-eye examination of the excised testicle, or even only after microscopy has been performed. Under the impression that they were probably neoplasms, I have removed one gummatous testicle, one testicle in a very atypical case of tuberculosis in which there were nodules spreading across to the opposite testicle, and one large swelling which proved to be an old hæmatoma of the epididymis. In the last two cases the diagnosis was finally made by microscopy.

Incision of the testicle for the purposes of diagnosis should not be made until it has been removed, as, if made before, it may cause recurrence. In 1927 Mr. Rawling (whom I wish to thank for permission to report this and other cases, and to operate

on several of them) removed, from a man aged 40 at St. Bartholomew's Hospital, a large scrotal recurrence, reported on as sarcomatous. Six years previously the patient had had similar swelling of the right testicle removed elsewhere, this swelling having been present for eighteen months. Regarded as a hæmatocele, it had been incised at operation. It is notable that, at the time of the second operation, this patient looked well, and his abdomen felt normal, in spite of a seven and a half years' history of neoplasm of the testicle and absence of radiotherapy.

In another case, I removed a scrotal recurrence, also labelled sarcoma, from a man aged 41. Although the testicle had not been incised at the time of orchidectomy. ten months before, recurrence may have been determined by the previous tapping of the swelling by his doctor, who failed to evacuate any fluid.

Prognosis: Treatment by orchidectomy and by X-rays.—Prognosis after simple orchidectomy is notoriously bad. Dew quotes Tanner's collection from the literature of 465 traced cases, in only 5½% of which, after four years from operation, the patients were alive. The elimination of previous tappings, the employment of greater clinical and operative gentleness, the reduction of manipulation to a minimum, ligature and cutting of the cord at orchidectomy before touching the testicle, and abstention from incising the testicular mass until after its removal—these are all points which may help to improve the outlook.

But perhaps the most important factor in improving the prognosis is the routine employment of post-operative deep X-ray therapy. Encouraging results have been published, including the disappearance of metastases. I know of a man, aged 43, from whom, in January, 1925, Mr. Rawling removed a large malignant abdominal testicle, and, eight months later, one of several oval purplish masses from the mesentery, Professor Kettle pronouncing the specimen to be a typical seminoma. The patient had subsequent X-ray treatment, repeated in October, 1930, for a large, hard, left inguinal mass, which disappeared. In November, 1932, having been admitted on account of subacute intestinal obstruction, which yielded to enemata, he was discharged well, nearly eight years after orchidectomy. It is such cases which encourage the suggestion that, with improvements in operative and radiotherapeutic technique, the prognosis, after careful orchidectomy plus X-ray treatment, may prove much better than after orchidectomy alone, especially careless orchidectomy.

The radical operation.—Finally there is the radical operation, which aims at removing the testicle and its lymphatic field up to the level of the renal veins in one clean, and let us hope not too bloody, sweep. I have never seen this done, but, with its described stripping of the ureter, and dissection carried across the midline in the region of the aorta and vena cava, it sounds a formidable operation, as is borne out by its mortality of 12% in Hinman's 77 collected cases, although Cairns reports 19 radical operations at the London Hospital with no deaths—an admirable and stimulating record.

I was not, however, tempted to try my first such operation on an only child, and I should be very loth to have a surgeon's fingers or scalpel operating near my own great vessels. There is a movement against ideal operations which kill. Many surgeons prefer perineal excision of the rectum to the more thorough abdominoperineal operation with its higher mortality. Such preference for a lesser procedure must be specially potent in the case of so minor an operation as orchidectomy.

In order to prevent the performance of the radical operation for non-neoplastic lesions of the testicle, cauterization of the cord and examination of the excised testicle, before proceeding further, have been recommended. Since in two cases already described the naked-eye appearances confirmed the suggestion of neoplasm, only later disproved by microscopy, these patients might have been unnecessarily subjected to the risk of death by those who favour the radical operation. Alternatively an immediate frozen section would be necessary, with its possibly doubtful verdict, or the completion of the radical operation after the lapse of some days. In any case,

such preliminary examination of the excised testicle, though in my opinion greatly desirable before proceeding further, somewhat invalidates the theoretical advantage of removal in one sheet of testicle and lymphatic field.

With regard to the possibility of such removal, Cairns quotes Jamieson's and Dobson's conclusion that complete removal of the lumbar glands and lymphatics is a surgical impossibility, and states that "the operation itself is so often disappointing: either there are metastases so closely adherent to the aorta or inferior vena cava that they cannot be removed, or there are no metastases, and the surgeon can find nothing to remove but the spermatic vessels and one or two small lymph-glands—a very small amount of tissue for such a large operation."

This confirms my suspicion that so heroic an operation must, as a rule, be either unnecessary, when there is no lymphatic involvement, or, when there is, impossible. With regard to results, Cairns concludes that they are slightly in favour of the radical operation. "Yet," he says, "it is questionable whether they are a sufficient improvement over the results of orchidectomy to justify the added risk." He states that "the London Hospital figures of 19 radical operations with no deaths do not give a true indication of this risk."

I venture to suggest that too few cases of the radical operation have been done and subsequently traced to prove that such good results as have followed it would not, in many cases, have followed orchidectomy alone; and that, even if the results prove to be somewhat better, they are offset by the much greater mortality of the bigger operation. The results of the radical operation must be proved to be far better than those of orchidectomy to justify incurring a mortality of anything up to 12% instead of perhaps 1%.

One must remember the occasional good results seen after orchidectomy—for instance, as already mentioned, survival for over seven years after simple orchidectomy, and for eight years after the combination of this with X-ray therapy. Mr. Lett removed a testicle in which there was a very early spheroidal-celled tumour, the patient being alive and well twelve years later. I should like to know whether the operation which produced this excellent result was orchidectomy.

In conclusion, despite the view expressed by some surgeons, that the radical operation is the only justifiable one, its results are unproved, and its high mortality must give us pause. At present, at any rate, the combination of orchidectomy and radiotherapy is probably the best that can be done for this terrible disease.

Summary—Most growths of the testicles are either teratomata or seminomata (carcinomata). Incomplete descent is a definitely predisposing cause; trauma is suggestively frequent before the onset of a growth; previous or co-existing inflammation is merely coincident. There is a heavy, painless, solid swelling of the body of the testicle. It is suggested that orchidectomy + radiotherapy is preferable to the radical operation.

References.—Cairns, H. W. B., "Neoplasms of the Testicle," *Lancet*, 1926 (i), 845. Dew, H. R. London, 1925. Walker, K. M., 1923. Webster, J. H. D. (70 cases), *Practitioner*, 1931, i, 636.

Mr. H. P. Winsbury-White: With regard to the point as to the association of new growth with ectopia of the testis, the following case is of interest. The patient, aged 27, had noticed a swelling in the right testicle during the previous six months. On examination I found this testicle enlarged to the size of a hen's egg and uniformly hard. There was no testicle in the left side of the scrotum nor upon careful palpation could I find this organ elsewhere. I performed right orchidectomy, dividing the cord in the upper part of the inguinal canal. Microscopical examination showed the testicle to be the seat of a small round-celled sarcoma, and a perivascular permeation of the lymphatics of the spermatic cord by the cells of the growth. Therefore one cannot hope for anything other than a very bad prognosis in this case, but its chief interest lies in the fact that it was the descended and not the undescended testicle which had become the seat of a neoplastic change.

Some Rare Cases of Enlargement of the Prostate.

By A. R. Thompson, Ch.M., F.R.C.S.

Through the years spent at a large hospital cases of unusual interest at times come within the experience of surgeons, and it may not be out of place if I am now permitted to record some such interesting cases of enlargement of or in the prostate gland.

I do not propose to give full details of these cases but I wish to point out that the diagnosis made in each case was my own and therefore liable to a certain prejudice, and perhaps to mistaken notions.

The first case is that of a man sent to me by Mr. E. C. Hughes at the end of 1916, with a diagnosis of enlarged prostate of a malignant nature. I agreed with this diagnosis, and decided that a suprapubic cystotomy might be the best treatment, as the patient was suffering a good deal of pain, and had complete retention. I carried out this operation and the patient was much relieved by the treatment.

The mucous membrane of the bladder was sutured carefully to the skin, and a large indiarubber tube was placed in the fistula which was formed. I remember at the operation thinking that the condition was undoubtedly one of malignant disease of the prostate, but that it might not have been primary in the prostate, but have originated in the pelvic cellular tissue, and from thence spread to the prostate. After the wound had healed and a fistula had formed, the patient was discharged to the out-patient department and kept under observation. The tube eventually was difficult to retain and worked out frequently. To my great surprise the fistula began to heal, and close, and finally there was complete closure, and the patient passed water without difficulty. The rectum was examined and nothing abnormal was found. The patient discharged himself from observation, and in 1920 came up to Guy's Hospital with a perforated duodenal ulcer for which he underwent an operation after which he died. The pelvic organs were thoroughly examined and nothing was found of an abnormal nature.

The next case was that of a young man who had an enlargement of the prostate which seemed to be malignant. The patient had a great deal of pain and implored me to do something for him, so I performed suprapubic cystotomy. I thought the malignant growth was possibly sarcomatous. The rectum was involved, and a portion of it was removed.

The patient never recovered from the shock of the operation, and died within twenty-four hours. Dr. G. W. Nicholson examined the tumour; he could not say definitely whether it was inflammatory or sarcomatous, but he was inclined to think that it was sarcomatous.

A third case was that of a middle-aged man who had somewhat excessive hæmaturia. I diagnosed malignant disease of the prostate gland, and removed the gland with a view to deep X-ray therapy later. This was carried out, and now, ten years after the original operation, the patient is perfectly well without any sign of recurrence. Dr. P. P. Laidlaw reported on a section of the prostate that it was either carcinomatous or inflammatory, but thought I could safely state that it was cancer.

The fourth case was that of a young man who had a hard nodular tumour which could be felt per rectum, in the position of the prostate. There was no discharge from the urethra, nor was there any history of any discharge. I warned the friends that the patient might be suffering from carcinoma of the prostate gland, and he was admitted to Guy's for operation. Within ten days of his being first seen, the tumour of the prostate had entirely disappeared, and the patient has remained well up to the present time (about seven years).

It may be said that these cases show a wrong diagnosis, but it is curious, if this be so, that in the two cases in which pathological examination was carried out, two

such distinguished pathologists as Dr. Nicholson and Dr. Laidlaw should be in doubt as to the nature of the tumour.

Carcinoma of the prostate may occur in combination with gonorrhœa. Such a combination is well illustrated by the case of a Belgian refugee who was sent to me with a diagnosis of gonorrhœa, the finding of gonococci confirming this diagnosis. There was, however, an enlargement of the prostate which was at first naturally thought to be of an inflammatory nature, but I was always a little doubtful about the diagnosis, as the tumour was certainly not tender, and was never very painful.

After the patient's admission to hospital, secondary tumours quickly appeared in the liver. The patient died, and it was evident that there was cancer of the prostate gland with secondary deposits in the liver.

I believe that if there had not been the gonorrhœa, no particular attention would have been paid to the prostate, except as a possible complication of gonorrhœa, and this rather suggests—as I believe is commonly taught in France—that if a tumour is suspected to be primary, and turns out to be secondary, it is secondary to a malignant prostate.

In this connection I may record the case of a man sent to me with a diagnosis of malignant prostate. With this diagnosis I agreed, and though the prostatic growth might have been removed locally, the discovery in the abdomen of an entirely unsuspected tumour which had led to no untoward symptoms, precluded anything but some such operation as suprapubic cystotomy, for the relief of any retention. The patient, however, was not ill enough for this, and he was discharged. The swelling lay chiefly on the left side of the abdomen, having its centre about the level of the umbilicus, and unless the prostate had been examined considerable doubt as to the nature of the tumour might have been excused.

I will now record a case of recurrence of malignant disease after removal of a tumour that had appeared to be simple. I will however preface the account of this case with notes of another:—

A man came to me in 1916 with an apparently simple enlargemant of the prostate, and I recollect the case well, as three points were emphasized in my mind. First, I believe that I could have performed the operation of suprapubic removal perfectly well without an anæsthetic, so overcome was the patient by the preliminary drugs that had been given by the anæsthetist, namely hyoscine, atropine, and morphine.

Secondly, the prostatectomy was the most rapid that I had carried out up to the year 1917, and thirdly, the patient, though aged 78, was sitting up before the ward fire within forty-eight hours of the completion of the operation. When a macroscopic examination was made of the portion of prostate removed there was no sign of malignancy. The patient was very well for five years after this operation, but was then admitted on account of further trouble, and died. At the post-mortem examination malignant disease was found in the remains of the prostate and also in the lumbar glands and in the bowels. Amongst these last deposits one was found at the tip of the appendix, the position of which was not noted by the examiners.

The case to which the above account is a preface is one of real interest, and may be instructive in this connection. It was that of a middle-aged man from whom I removed a normal-looking adenoma of the prostate by the perineal route. The patient did well after the operation, but had to have instruments passed as there was some dysuria. He quickly recovered from this, however, and was perfectly well for three years afterwards.

In 1931, however, he arrived at the out-patients' department of Guy's Hospital with what was clearly not a simple prostate recurrence. I again incised the perineum with a view to introducing radium, and I cut into a soft mass in the right lobe of the prostate. I removed some tissue from the tumour and it was found to be papillomatous. It was suggested—but I am not sure whether by any responsible histologist—that the growth might be a papilloma of the bladder.

There had been no clinical evidence of this condition, and I looked up the microscopic sections of the original tumour of the prostate. It was decidedly papilliferous, much more so than the sections of other prostates that I have examined.

Radium was inserted and seemed to do good for a short time. The tumour apparently disappeared, but it quickly returned and the man is obviously sinking at the present time, if indeed, he is not dead.

Now I think that this case will answer some questions that surgeons who commonly perform prostatectomy for simple prostate enlargement must ask themselves. We know that papillomata may not be at all innocent in their behaviour. I have in mind the case of a woman with a papilloma of the pelvis of the left kidney associated with a stone in the pelvis, and the production of a pyonephrosis. I removed this and a local recurrence under the scar was removed later. Later still a recurrence was removed from the left side of the aorta, and after this signs of spinal involvement developed and the patient died with paralysis.

Does not the main case indicate that papilliferous tumours of the prostate may in fact be malignant and not simple, just like some of the papillomata occurring in the bladder and pelvis of the kidney? And there is another point. I have had two or three cases of enlarged prostate associated with a papillomatous condition of the bladder. May not the papillomatous condition of the bladder have originated in the prostate? The case, indeed, seems to throw some light on those cases in which a malignant condition appears to follow upon the removal of a simple prostate enlargement.

Some Observations on Temporary Drainage of the Kidney.

By Victor W. Dix, F.R.C.S.

Abstract.—Temporary drainage may be necessary for the success of an operation, as, e.g., a plastic operation on a hydronephrosis. It may, however, also be used as an aid to recovery of function by a damaged kidney; its use in these cases is not a necessity but is an optional point in technique.

The method of drainage should be simple to adjust at the time of the operation, easy to control during the post-operative period, and one which causes no damage to the kidney when the drainage tube is removed. The technique of such a method is described. Some difficulties in operative technique, and in post-operative management, are considered, and the normal course of drainage in these cases is outlined.

An additional point in favour of the method is that it can be used both in those cases in which drainage is necessary and in the others where it is not; and the experience gained by overcoming difficulties and complications in those cases where drainage is not of vital importance is of the greatest possible use in establishing a good technique for those cases in which failure of the drainage system would imperil the success of the operation.

It is not my intention in this short paper to discuss the indications for temporary drainage of the kidney. I propose only to make some observations on the technique and operative difficulties of the method of drainage which I have used in a series of fourteen cases. In certain operations on the kidney some method of diverting the flow of urine is of vital importance to the healing processes and if the drainage system fails, the operation is doomed to failure. A good example of this type of operation is a plastic operation on a hydronephrosis. Three of the cases of my series were of this type; in the other eleven cases stones had been removed from the kidney, in ten of them by pyelotomy, and in one by nephrotomy. In the cases in which I had removed stones I drained the kidney for two different reasons: in some cases in an endeavour to save a badly damaged kidney and enable it to recover its function, and in others, which were usually uncomplicated cases of oxalate calculi without infection of the urine, not from any conviction that drainage would prevent

or delay further stone formation, but rather as an exercise in perfecting the technique of the method in order that I might be able to use it with greater certainty in those cases in which its use is essential to success.

It is probable that drainage after removal of a stone at least cannot possibly do any harm, provided that the method adopted fulfills the requirements which I shall shortly mention, and the experience gained from these cases, in which it does not matter very much whether the drainage succeeds or not, is of the greatest possible value in the case of plastic operations.

Before discussing the actual technique of the method I have used, I will suggest a few things that are essential in any good system of drainage for the kidney. The tube used should be simple and easy to adjust, and there should be no difficulty in making a watertight joint where the tube leaves the kidney. This joint should, of course, remain watertight until the tube is removed. The tube should not interfere with the outlet mechanism of the kidney and the urinary fistula left when it is removed should close at once, or within a very short time after its removal. It is for this reason that I do not like pyelotomy but prefer to drain through the kidney substance, since it will be generally agreed that the fistula left after drainage through the pelvis takes a long time to heal.

Another important point is that the removal of the drainage tube should not cause any unnecessary damage to the kidney. The self-retaining tube fails in this respect, since the principle adopted to hold the tube in the kidney is some variation of the expanded end. There is a possibility that the moderately strong pull required to dislodge these self-retaining tubes when drainage is discontinued might cause damage to the kidney. This, of course, usually does not occur, but I have always felt, when removing a tube of this sort, that I might start a hæmorrhage that would be difficult to control.

The method I am going to describe fulfils, I think, the conditions I have set out. It is not my own, and I should like to take this opportunity of expressing my gratitude to Professor von Lichtenberg, from whom I learned it when I was working at his clinic in 1930.

Technique.—The technique is simple. The drainage tube is a No. 16 (French) whistle-tip catheter, with two lateral holes in addition to the terminal hole. This is introduced and fixed in the following manner (it may be assumed that the drainage is being used in a case in which a stone has already been removed by pyelotomy) :—

Through the opening in the pelvis a pair of special forceps are introduced. These forceps are of Professor von Lichtenberg's design, and are of four patterns, each bent in a different manner, so that whatever the difficulty of access to the kidney it is always possible to find one pair that can be introduced easily through the open pelvis. This avoids any possibility of having to cut the cortex of the kidney in order to introduce the catheter. The point of the forceps is then pushed out through the renal substance, so that it will emerge somewhere in the lower third of the kidney, at its convex border and slightly on its posterior surface. A little hæmorrhage may follow, but it is never troublesome.

The whistle-tip end of the catheter is then grasped by the forceps and drawn back into the pelvis, where it is adjusted so that it lies comfortably. When it is in the right position the catheter is grasped by the assistant with a pair of forceps where it emerges from the kidney. A catgut suture is passed through the catheter, which must be firmly held at this stage, or it will be pulled out and a further adjustment will be necessary; the suture then picks up a piece of the capsule of the kidney and the catheter is fixed. The pelvis is then sutured. One or two cubic centimetres of fluid can be introduced through the catheter into the pelvis to see whether the pelvic suture line is watertight or not, and in order to wash out any small clots.

The kidney is now returned to its position, the perinephric drainage tube is introduced, and the wound is sewn up. The drainage tube and the catheter draining the pelvis are allowed to come out of the wound at the most convenient place. This will often be found (in the case of an oblique incision in the loin) to be about one-quarter or one-third of the total length of the wound, away from its most anterior point. The catheter is then attached to the skin by a suture of whatever material is being used for the skin sutures, and it may be washed out again gently to remove small clots.

The above description represents the operation at its simplest, and difficulties usually do not arise. In certain cases, however, there may be difficulties. If for any reason there are dense adhesions between the capsule of the kidney and the perinephric tissues, such as may occur, for instance, in cases in which a previous operation has been performed on the kidney, it may be necessary, in order to free the kidney, to work inside the capsule. In these cases the attachment of the catheter to the kidney substance must be made very carefully, and, of course, the attachment is not so secure as it is when the capsule is undamaged.

Another difficulty presents itself when the kidney is very movable. An ordinary range of movement does not matter, but it sometimes happens that the kidney has a large range of movement and can be seen to move violently up and down with the respiratory movements during the operation. In two of my cases the kidney was very movable. In these I left a loop of catheter between its two points of fixation, i.e., the movable point on the kidney and the fixed point on the skin. The tubes worked satisfactorily and there was no leakage. I believe, however, that it would be better in all these cases to fix the kidney by some simple method, in order to avoid the danger that must always be present when the catheter is fixed at two points, one of which is moving through a considerable distance.

Post-operative difficulties are not many in number, but one of them may be of serious consequence. Blocking of the catheter occurs very easily during the first twenty-four hours, and it may be only by constant attention that it can be kept clear. This does not always happen, but it is a good thing to establish a post-operative routine, in order that no harm may be done, should it occur. The catheter should be examined every hour, and, if it is not dripping freely, should be syringed through with saline. Two cubic centimetres is a suitable quantity to use and should not usually be exceeded. This can be done by the nurse in charge of the case, or in the case of hospital patients by the house surgeon. At the end of twenty-four hours the chance of blocking is remote, although the urine may be blood-stained for three or four days. It is, of course, particularly in those cases in which drainage is used in order to ensure healing after plastic operations that this danger of blockage is so serious, but fortunately bleeding occurs less frequently in these cases than in those in which a stone has been removed.

After the third day drainage is usually uneventful. In the ordinary case the quantity of urine coming through the drainage tube increases daily until about the seventh or eighth day, when it reaches a maximum which is maintained until the end of drainage. A typical series of figures taken from one of my cases is as follows, the drainage being expressed in ounces in the twenty-four hours: 2½, 5, 5½, 6, 7 (last blood-stained specimen), 12, 14, 14, 15, 11, 20, 3. The small amount on the last day is accounted for by the removal of the drainage tube.

Drainage is maintained for from ten to fourteen days, and at the end of this time one of several things may happen. Drainage through the tube may stop suddenly and the amount of urine passed naturally may increase. In these cases it will be found that the tube has worked its way out of the kidney, although it may still be attached to the skin or the dressings may become wet through leakage of urine round the catheter, and in this case the tube should be removed at once. On the other hand, there may be no cessation of the flow of urine through the tube,

and no leakage round it, but when the skin suture is removed it is obvious that the tube is loose and it can be removed at once. In many cases the wound remains dry from the time of removal of the tube, and if there is a urinary fistula afterwards it does not usually persist for more than a few days.

I have never seen any bleeding or other complications when the tube was removed. It may sometimes occur after the wound is dry that there is a rise of temperature, accompanied by pain in the loin, which is relieved after from twelve to thirty-six hours by a gush of urine and the establishment of a urinary fistula which persists for a few days. In a successful case of a plastic operation on a hydronephrosis there was symptomless hæmaturia for two or three days a fortnight after the tube had been removed and the wound completely healed.

Summary of cases.—My series of fourteen cases was made up as follows:—

There were three plastic operations for hydronephrosis, of which two were successful and one was unsuccessful. Failure in the unsuccessful case was due to the fact that the drainage tube was allowed to block during the first thirty-six hours, and healing therefore did not take place between the re-implanted ureter and the refashioned pelvis. Nephrectomy had to be performed four weeks later.

Of the eleven cases in which stones were removed, seven were uncomplicated cases of oxalate calculi with uninfected urine, and in none of these has there been a recurrence of the calculi. It is not claimed, however, that drainage has had any effect on the result in these cases.

The other four were all cases with infected urine and phosphatic calculi and debris in the pelvis. In three of these cases the stones recurred within six months, whilst the remaining patient is still free from trouble two years after the operation.

Mr. H. P. WINSBURY-WHITE: My personal experience of temporary drainage of the kidney concerns four types of case:—

(1) Dilated and infected kidneys with bilateral calculus, in which drainage followed the removal of the stones. (2) Dilated and infected solitary kidney with calculus, in which drainage followed removal of the stone. (3) Pyonephrosis with drainage as a preliminary to nephrectomy. (4) Drainage as a step in a plastic operation for hydronephrosis.

In Nos. 1 and 2 the kidneys were in such a condition that they would have been removed had there been a healthy organ on the opposite side. My experience of this kind of case with and without post-operative renal drainage impresses me with the tremendous advantage of the procedure. I can recall several cases of dilated and infected kidneys from which I had removed stones, after which I closed the kidneys completely, with the result that the convalescence was far from satisfactory. The danger of introducing urea-splitting organisms into the kidney and thus encouraging further calculous formation has been the primary justification for completely closing the kidney after the removal of stone. My personal experience leaves me with the conviction that this theoretical disadvantage sinks into insignificance in the face of the benefits which accrue from following the well-established surgical principle of providing adequate drainage for sepsis.

With No. 3 my one experience of this method of the procedure compared with nephrectomy in the first instance in several other cases, has made me certain that the latter is the better procedure. The patient was a girl, aged 15, with a history of a swinging temperature for some weeks, and a large tender swelling in the left loin. Pyrexia with a malar flush and emaciation were noted at this time. I cut down and drained the kidney, but this did not cause the temperature to settle. Fourteen days later I made a further incision into the kidney. This likewise failed to remedy the unsatisfactory state of affairs. The patient survived only for a few days. The difficulty in this case was caused by the wide dilatation of the calyces which could only be adequately drained by extensive and multiple incisions into the kidney. Since my experience with this case, which was six or seven years ago, I have always performed nephrectomy in one stage with satisfactory results.

In the fourth type of case I have carried out kidney drainage as a step in the plastic procedure for hydronephrosis according to the technique of von Lichtenberg, to which Mr. Dix has referred in some detail. One of the most striking results of this technique is the assurance with which primary union is obtained between the ureter and the pelvis. I have performed this operation on seven cases. In the first six, I kept strictly to the

von Lichtenberg technique, except for the fact that in the sixth case the catheter was accidentally removed on the third day. Urinary fistula resulted and pyelography subsequently showed that the ureter and the pelvis had parted company, and I had to carry out nephrectomy as a consequence.

I was extremely interested in the pathological changes which were to be seen both macroscopically and microscopically in this kidney. First of all there was a pale ischæmic-looking zone in the renal substance, half an inch wide, extending across the lowest third of the kidney and there were other irregular blood-stained areas of degeneration in other parts of the renal substance. Microscopically it was seen that there was a widespread hyaline-like degeneration throughout the kidney and a certain amount of leucocytic infiltration. These changes made me feel that drainage by tube through healthy renal substance has its disadvantages. In the seventh case in which I operated, I was therefore tempted to modify the von Lichtenberg technique by making the catheter leave the kidney not through the renal substance, but through the upper part of the pelvis. I must confess that there was a distinct disadvantage from this procedure, in that a urinary fistula persisted in the loin for several weeks.

In the cases of badly infected and dilated kidneys which I first mentioned, the likelihood of damage to the renal substance from the persistent drainage does not exist, because one makes a point of passing the tube into the kidney through a thinned area of the cortex.

JOINT DISCUSSION No. 5.

Section of Neurology and Section of Psychiatry.

Chairman—J. S. RISIEN RUSSELL, M.D. (President of the Section of Neurology).

[*January* 19, 1933.]

DISCUSSION ON THE MENTAL AND PHYSICAL SYMPTOMS OF THE PRESENILE DEMENTIAS.

Dr. Macdonald Critchley: To the neurologist, presenile dementia usually offers itself as a problem in differential diagnosis. The occurrence of a progressive intellectual deterioration in a hitherto healthy person of middle age, indicates of necessity structural cerebral change of demonstrable character. As the result of his investigations, the neurologist will find that the majority of his cases will comprise one of three ætiological types, namely neoplastic, syphilitic or arteriosclerotic. A smaller group of cases will be accounted for by the progressive dementias associated with chronic epilepsy, and with certain chronic toxi-infectious processes, especially alcoholism and uræmia. Trauma will account for a small number, either in the nature of the psychical symptoms of chronic subdural hæmatoma, or from a more generalized molecular effect. Certain progressive and long-standing disorders of the nervous system tend to be associated with corresponding mental deterioration, as, for instance, Huntington's chorea, epidemic encephalitis, and disseminated sclerosis.

There remains a mysterious group of disorders—the presenile dementias proper—in which focal signs together with intellectual decay are associated with distinct types of histological change within the cerebrum. Two disorders in particular belong here, namely, Pick's disease and Alzheimer's disease. Those rare and curious cases of cerebral gliosis occurring during the presenium, described by Spielmeyer and by Kraepelin, should also be included. I deliberately omit from this category that clinical suspect presbyophrenia, as being of doubtful parentage and uncertain pathology.

In discussing the presenile dementias, we to some extent are standing on solid earth, in that our data are largely pathological and ætiological in type, and are to a considerable extent unassailable. Perhaps the very definiteness of the subject explains the lack of interest which this chapter in neuro-psychiatry arouses.

Owing to the scant attention devoted to these presenile psychoses proper in the British textbooks, it may perhaps be useful to state the chief clinical and anatomical features in the diseases described by Pick and by Alzheimer respectively.

In 1892, Arnold Pick reported two cases of dementia in elderly people, mainly because of their interesting visuopsychical symptoms. The pathological findings were unusual, comprising a symmetrical atrophy of certain areas of the cortex, without corresponding change of a "senile" character, and also without evidence of arteriosclerosis. It was then realized that Pick had stumbled upon something new in clinical psychiatry: other analogous cases were recorded and gradually the conception of Pick's disease grew up as a form of presenile dementia with focal symptoms characterized anatomically by circumscribed areas of cortical atrophy. Using as our data the few score cases in the literature, we know that symptoms usually begin between the ages of 50 and 60; and that women have been more often affected than men. Symptoms of a psychological character develop insidiously. Schneider recognizes three stages in the progression: (1) a phase of restlessness, in which the patient becomes exalted and euphoric and often disordered in conduct; (2) a progressive demential stage, to which focal manifestations are added; and (3) a terminal stage of cachexia and complete dementia, with contractures, bedsores and incontinence, and at times, convulsions. The course of the disease is usually slow, lasting from two to twelve years, though Schneider has described an acute form in

which rapid loss of weight accompanies the quickly advancing dementia. The focal manifestations, which are important features in Pick's disease, vary according to the particular regions of the brain implicated. Aphasia, especially of the receptive type, is very common, but agnostic defects in tactile and visual spheres also occur. The morbid anatomy consists in a general brain atrophy together with a severe bilateral and usually symmetrical wasting of various cortical regions, varying from case to case. Thus while the middle portion of the temporal lobe is most commonly affected, the frontal, parietal, occipital or insular cortices may be involved. Histological examination shows a numerical cell atrophy, especially in the three outer layers of the cortex. The remaining cells show atrophic and argentophil changes; there is a secondary glial increase. Mention must especially be made of diffuse depositions of iron. It must be emphasized that unlike the anatomical findings in senile dementia and in extreme old age, there are no Alzheimer fibrillary changes[1] within the nerve-cells and no senile plaques. Furthermore, cerebrovascular alterations do not exist. The areas of cortical atrophy are mysterious in that they do not correspond with particular vascular territories, nor with Flechsig's zones of myelination. A correspondence with Brodman's cytoarchitectonic areas is only approximate, though Kaplinsky has endeavoured to show that the youngest regions of the cortex are most likely to be affected.

We are still in the dark as to the nature of this disease. Pick originally suspected an unusual form of cerebral arteriosclerosis, but, following Stertz, we now realize that this is not so. A localized premature involutional process has been mentioned. and also a hypothetical disorder of iron metabolism. Perhaps most credence is due to the conception of a late heredodegeneration. It has long been known that a family history of dissimilar psychoses has been recorded in a number of cases, but the occurrence of Pick's disease itself in two or more siblings had not been noted until Grünthal's publication in 1930.

Alzheimer's disease is of more recent recognition than Pick's disease. In 1906, Alzheimer described to the South-West German Psychological Congress a form of presenile dementia in which there occurred a pathological process of striking intensity. Two years later, Bonfiglio and Perusini studied this and some other cases with minute histological care. The usual age of onset lies between 40 and 60; the course may be slower than in Pick's disease, and may extend to twenty years. A slowly advancing dementia is the outstanding symptom, often accompanied in the early stages by excitement, restlessness, irritability and pugnacity. Alterations in behaviour may occur at this time. In this psychosis also, focal manifestations are important and special mention must be made of periodic fits. Although the course is typically progressive, remissions have been described, lasting months. The pathological appearances recall those of senile dementia but differ —not only in their occurrence at a relatively youthful age—but also in their diffuseness and their intensity. Here, senile plaques are encountered in profusion, and it was in this disease that Alzheimer first described that peculiar intracellular change which bears the name of "Alzheimer's tangles." We now realize, of course, that these are not pathognomonic of Alzheimer's disease.

The nature of Alzheimer's disease is still uncertain; Grünthal mentions two views: (1) this psychosis may be the expression of a form of dementia accompanying a premature senility, and (2) it may be the effect of an exogenous toxi-infectious process. The former view, while compatible with the anatomical findings, does not explain why the changes should be so intense nor why they occur prematurely.

It is probable that these two forms of presenile dementia are not as rare as we perhaps believe. Even at autopsy, I suggest that we at times fail to recognize the condition, and erroneously label the case as one of arteriosclerotic brain disease. How the diagnosis is to be made during life, or whether indeed it can be made, is open to discussion. To-day, the diagnoses of Pick's disease and of Alzheimer's

disease are possible mainly by elimination. If in a case of presenile dementia with focal manifestations we can exclude arteriosclerosis, tumour and syphilis, we should then consider the psychoses of Pick and of Alzheimer.

Still harder is the difficulty of distinguishing the one from the other; I would like in this connection to emphasize the family history. If there is a story of similar or even dissimilar psychoses among the relatives, then Pick's disease is by far the more likely diagnosis.

Short-cuts to diagnosis are still treacherous. Bingel thought that encephalography helped him to make the diagnosis during life by demonstrating a frontal atrophy, but it is possible that very similar pictures might be obtainable in other forms of presenile dementia. Perhaps there is no way of making a certain diagnosis in vivo, except by resorting to the crudities of the experimental brain-puncture.

We may now consider, shortly, a relatively unexplored aspect of the presenile dementias, namely, the objective neurological manifestations. Scarcely any attention has been devoted to the physical signs in these psychoses, with the notable exception of such authorities as Steck, and in particular Karl Kleist. Although the nervous system is frequently dismissed as normal from superficial examination, nevertheless physical signs are often present in abundance.

Focal manifestations may be demonstrable in several types of presenile dementia, as for example in the psychoses of Pick and of Alzheimer, and in the arteriosclerotic, syphilitic and neoplastic forms. Interference with the projectional system of fibre-tracts will be an important factor in the production of alterations in the reflexes, pyramidal signs, defects in the visual fields and localized disorders of sensation or of motor power.

Implication of the commissural and associational fibres may result in the appearance of a large number of manifestations of a more complex character. Here will belong the various speech disorders, certainly those of an aphasic type, and probably also such phenomena as dysarthria, echolalia, palilalia, and other speech iterations. The various types of apraxia, ideatory, ideomotor and motor, belong here. Furthermore there may arise numerous psychosensory defects, of an agnostic type, whether visual, tactile or auditory.

Besides the foregoing evidences of focal disease there may also exist certain general signs, which are probably independent of any macroscopic lesion in the cortex or white matter. To these manifestations, the term " psychomotor disturbance" is usually applied, as they mainly comprise complicated alterations in motility, posture and tonus. We may roughly subdivide them into two groups, the hypokinetic and hyperkinetic, according as to whether motor activity is depressed or increased.

Among the hypokinetic signs, we note a general fixity of attitude and stance. There is a poverty of movement amounting at times to a distinct state of Parkinsonism. To these is added a slowness of movement—later, a slight reduction in motor power and an attitude of flexion. A peculiar fixity and often vacuity of expression recalls the mask-like facies of the Parkinsonian. Passive manipulation of the limbs and trunk usually reveals a curious and often valuable resistance which amounts at times to a pronounced hypertonus. Often it is erroneously attributed to a failure of relaxation on the part of the patient. Foerster's arteriosclerotic rigidity of course belongs here. The assumption of fixed postures in an anti-gravity attitude, is a most important physical sign, to which the term " catalepsy " is applied on the Continent, and which we speak of as " catatonia " (or flexibilitas cerea). Catatonia is one of the most important physical signs and serves to distinguish the Parkinsonian states in the demented, from other varieties of Parkinsonism. It may appear, not only with appropriate manipulations, but also spontaneously, as in the well-known " psychical pillow." Related to catatonia is the phenomenon of palipraxia (or the execution of

echo-movements by the patient) and also counter-pull (the " Gegenhalten " of Kleist), whereby a passive movement is resisted by a movement in an opposite direction.

At a later stage, the hypokinetic syndrome leads to severe and disabling contractures. A progressive poverty of speech eventually leads to a final alogia or mutism.

The hyperkinetic manifestations include spontaneous movements which vary widely in their nature, constancy and complexity. At one extreme, we have simple tremor: this may appear in the lips, face, tongue and extremities, as characteristically in the syphilitic and alcoholic types.

States of motor agitation or general restlessness are rarer but are described in presbyophrenia: here differential diagnosis has to be made from an early Huntington's chorea. More complex are the curious and often repetitive movements such as clapping the hands, rubbing the palms together, picking, touching, plucking and fingering the bed-clothes and other nearby objects. Such are encountered especially in the arteriosclerotic varieties and indicate generally an advanced stage of dementia.

The grasping of objects within reach, together with the tendency to grope blindly in the air, is common in the late stages. Later still, one may observe the patient clutching objects and transferring them to the mouth; while a finger or some other article placed near the patient's mouth may be snapped at and bitten and give rise to movements of chewing and of sucking.

Dr. R. D. Gillespie: The senile and presenile psychoses have received remarkably little attention in psychiatric literature in this country, either from the clinical or histopathological point of view. A considerable amount, on the other hand, has been done on the Continent and in America, but even there it is felt that the subject is in an unsatisfactory condition. Kraepelin describes the presenile psychoses especially, as one of the obscure pages of psychiatry. As a basis for discussion it is important to have a classification. This has to be on clinical grounds, because it is now generally agreed that the histopathological differences which are found are too variable to form a satisfactory basis for classification. A number of leading types can be distinguished, but it is important to remember that there are individual cases that it is impossible to assign to any of these types.

The classification I would offer is as follows: (1) Simple presenile dementia; (2) Alzheimer's disease: (3) Pick's disease; (4) Presbyophrenia in the various meanings assigned to it by some authors: (Kraepelin puts it among the senile dementias); (5) Kraepelin describes a number of other conditions which he attempts to differentiate.

About four of the sub-groups in Group 5 are dementias in the sense of this discussion, i.e. failure of intellectual function is a leading feature associated with cortical degeneration, but the differentiation between these sub-groups is not very clear and it is doubtful whether it is very useful.

The presenile dementias occur anywhere between the ages of 40 (some would say 30), and 65. They are characterized by:

(*a*) Gradual failure of the intellectual functions with a progressive diminution of energy and initiative; various disorders of mood, and alterations in behaviour dependent on these other changes.

(*b*) Certain neurological signs predominantly of focal type.

(*c*) Tissue changes in the brain of a degenerative type resembling those seen in many senile brains, and

(*d*) An idiopathic origin.

Upon the basic mental symptoms of progressive failure of intellect and of interest, other symptoms are from time to time imposed. These are (*a*) those directly following from the intellectual deterioration, namely, lack of insight, confabulation and " false recognition "; (*b*) affective disturbances: anxiety, depression, apathy,

euphoria, irritability, suspicion and emotional lability; (*c*) disorders of conduct, including all degrees of deterioration from the ordinary social level to restlessness, agitation, childish behaviour, and stereotyped activity in speech and action.

To these purely mental symptoms, as it were, are added in most cases, sooner or later, focal signs at the symbolic level, in the form of various aphasias and apraxias.

These are important for several reasons, one being that they serve clinically to differentiate some of the presenile syndromes, neither the basic nor the accessory mental symptoms being sufficient for this purpose. The purely mental symptoms, however, can exist alone, and that is the justification for the tentative separation of Group 1. In this provisional group the "basic" mental symptoms may exist alone for several years at least before the development of either the accessory mental symptoms or of focal asymbolic ones. Such gradual failure of the intellectual functions and of interest, occurring in a person between the ages of 40, or possibly 30, and 65, apart from any evidence of arteriosclerosis, neoplasm, trauma, infection, or intoxication is presumptive of a presenile dementia, which may be of a simple type or may be more probably an early stage of Alzheimer's disease, or less probably, the rarer Pick's disease. Whether a simple type of presenile dementia occurs *per se* or whether it is always an early stage of one of the others, it is neverthless important to be aware that a clinical picture corresponding to this description does exist, for, as the symptoms are extremely insidious, there is grave danger to the patient's welfare and the conduct of his affairs so long as the condition goes unrecognized. The danger is greater in this respect than, for example, in general paralysis, because the progress is on the whole considerably slower, and confirmatory neurological signs are longer wanting. I am tempted the more to put forward the hypothesis of a separate group of this simple type for the reason that some at least of the few cases I have seen belong to this group and had displayed symptoms for about four years before I saw them. The recognized types of presenile dementia show a rate of progress which would have made the appearance of focal symptoms probable earlier than four years from the first discernible symptoms. Possibly the reason why they have not been described in textbooks or even in monographs, may be that the books are concerned mainly with institutional experience, which of course means end-results rather than early stages. On the other hand, cases of this type may be, as Henderson maintains, really instances of what is called by some authors "presbyophrenia," the absence of confabulation depending on the, as yet, comparatively slight disturbance of memory in the earlier stages or milder degrees of the condition. The following is an illustrative case:—

A married man aged 55, a clerk, had, for the past four years been taking little interest in his work and recreation, and had been increasingly forgetful. His brother reported that he had always been quiet, but during the previous four years had become much quieter and talked very little. For example, when spending a week-end with his brother, he would come into the house, say "How-do-you-do," get a book and say practically nothing further all the week-end. He seemed simply apathetic. Every now and then he would "wake up for a bit" and would laugh at a joke. He would go for a walk, but would not talk, except in answer to questions and then very briefly. When his son came home from sea on short leave he showed no interest in him.

On examination.—The patient looked neither older nor younger than his years. His demeanour was normal; he answered questions willingly but spoke slowly. There was no apparent disorder of mood. The only thing noticeable in the affective sphere was his lack of concern about his position, though his job was by this time in jeopardy. This lack of concern depended partly on a lack of insight, for his intellectual difficulties were evidenced, on testing, as follows:—

When were you married? 1910. How long ago was that? Oh, 32, 42. How long ago was that? 42, 1890, 1902, 1910—42. When I asked him to substract 1910 from 1932, he answered correctly 22. What age are you? 53 (he was in fact 55). What year were you

born in? 1877 (this was correct). What age are you? 55 (which was in fact correct). What was the date of the Armistice? 1919. When did you first change your job? Ten years ago, during the war. During the war? How long ago was that? Oh, twenty years ago. (I repeated the question.) Oh, sixteen years.

Thus it will be seen that he was very vague and inaccurate in his replies, and did not recognize his errors till attention was called to them: in fact he did not as a rule recognize them then.

Simple calculations of another type consisting of subtraction showed errors which the patient did not spontaneously correct; 100−7=93 but 93−7=92. I asked him to do that again and he answered 86 which was correct. I asked for 7 from 86 and he gave me 59, and on being questioned corrected it to 69 which was of course still wrong.

Asked to recollect three objects he recollected one correctly, one incorrectly, and one not at all till reminded of it.

He had no insight for his change in disposition and energy and very little for his memory defect. He showed no speech or writing defect or defect of simple comprehension. But a special test of clerical ability (clerical work being his job) showed inadequate comprehension of simple instructions, failure in discrimination of simple classes of things, perseveration, and slowness in execution. His intellectual capacity fluctuated. After a rest of some weeks from attempts at work, his recollection of personal data improved but the remainder of his intellectual performance was as before. Physically there was no evidence of organic disease in his central nervous system or elsewhere. The blood Wassermann was negative. The condition can be differentiated from a late schizophrenia (which is Bleuler's conception of some of these conditions), by the retention on the whole of the personality, the lack of an impression of oddity of behaviour in any way, and by the presence of intellectual defect.

The differential diagnosis of such a simple dementing process as this is principally from the other types of presenile dementia, especially Pick's disease with preponderance of frontal atrophy, from simple schizophrenia, from chronic alcoholic brain disease, arteriosclerotic brain disease, general paralysis, chronic encephalitis and brain tumour.

From other types of presenile dementia the distinction is by the absence of any focal neurological signs and symptoms and the absence of confabulation (but the differentiation from an unusually slowly progressing Pick's disease is hardly possible during life): from simple schizophrenia by the defects of memory and errors in simple calculations, and from the other conditions enumerated by the history and by the absence of physical signs. In addition the arteriosclerotic and the chronic encephalitic would be expected to show a fair amount of insight. In the chronic encephalitic the memory and the other intellectual functions are not usually discoverably impaired.

It should be added, however, that evidence of an unusual kind that such cases as this can be after all early stages of one or the other recognized types of presenile dementia with focal signs has been obtained by Flügel, [2] who performed a brain puncture on the frontal lobe of a patient aged 54. This patient showed at that time only slowness of comprehension, memory defect and defective orientation, but with some insight, no aphasic or symbolic disturbances and a mildly euphoric mood. The tissue obtained by this method showed already well-marked neurofibrillary changes.

Alzheimer's disease has attracted a great deal of attention abroad. It was first described by Alzheimer [3] in 1906 in conjunction with what at that time was considered to be a specific histopathological change. It has been the subject of very few publications in this country. I doubt whether it appeared in any English textbook of psychiatry till 1927. It cannot be a frequent condition, as I

have always been on the look-out for it since 1922 when Henderson first drew my attention to it, and I have seen hardly any cases that seemed clinically indisputable.

Alzheimer's disease is a progressive dementia beginning in the fifth or sixth decade (possibly sometimes in the fourth decade) with focal disturbances of a symbolic, aphasic and apractic type, and with epileptiform seizures, ending finally in a bed-ridden completely demented condition with paresis and contractures of the limbs.

The histopathological changes which have been described as characteristic are now known not to be peculiar to any one condition but to be associated with all kinds of senile dementia and even with other conditions not senile in nature. Fibrillary alterations are not distinctive of any type of mental disease, according to Grünthal. Plaques have been found in brain atrophy after head injury. Both plaques and fibrillary alterations have been found in senile brains which have not been accompanied by senile dementia. Plaques have been seen in cases not of senile type. Fibrillary alterations have been described in amyotrophic lateral sclerosis, in poliomyelitis and cholera and in normal old people. According to Grünthal [4] no case of senile dementia appears without plaques, which, together with fibrillary alterations, make a fairly characteristic picture but not one from which alone a diagnosis can be made. Alzheimer in 1911 described a clinically typical case of his disease with plaques only.

The clinical course has been conveniently divided into three stages by Grünthal (quoted from Henderson and MacLachlan [5]).

(1) A stage of gradual loss of memory and disturbance in perception, carelessness in work and appearance, disorientation for place weakness or epileptiform attacks, with some loss of words and slurred speech.

(2) Complete disorientation for time, place and person, dulling of comprehension, inability to read, write or do simple arithmetical sums.

(3) A stage of extreme irritability, with paraphasia, uncleanliness, stereotyped movements.

In addition some writers, for example Hertz and Funfgeld [6], describe affective disturbances in the first stage in the form of anxious agitation, irritable paranoid conditions and expansiveness. They remark that the differential diagnosis from endogenous affective disorders may be impossible at this stage. They emphasize later, restless activity during the day time with an occupational colouring, and a speech disturbance of the type of logoclonia. They also emphasize disturbances which they refer to the vegetative system, namely, loss of weight and disturbance of sleep.

The course is a fairly rapid one, a considerable amount of dementia being attained in about two years. Convulsions are recorded in most cases. Differential diagnosis is similar to that already mentioned for the so-called simple presenile dementias. In addition cases have been confused with amoytrophic lateral sclerosis or a condition resembling that. Hertz and Funfgeld have described a case as Pick's atrophy which Grünthal [7] considers to have been Alzheimer's disease with a specially great degree of atrophy in the temporal lobes. Malamud and Lowenbergs, from cases described by them which resembled Alzheimer's disease, one of which may have been arteriosclerotic in origin and the other perhaps a stationary general paralysis, conclude that Alzheimer's disease results from a number of causes, e.g., toxic, infectious, etc. Similarly two Russian authors quoted by Grünthal have sought to attribute a case of Alzheimer's disease to brain trauma. None of these, however, were typical cases. Alzheimer's disease, presents a fairly well-defined clinical picture. The conclusions as to ætiology made by these authors therefore seem to beg the question. A theory about the ætiology which naturally suggests itself and which is favoured by Henderson [8] as a result of inspection of ten or twelve cases of his own, is that the process may be dependent on inherited factors. Henderson has data suggestive of senile and presenile types of dementia in the direct ancestry of a number of his patients. Schottky [9] has presented some data pointing in the same direction.

The concept of presbyophrenic requires some elucidation. The term is used very differently by different authors and sometimes, as Bleuler [10] remarks, by the same author at different times. Henderson uses the term to cover such cases of simple presenile dementia as I have described, and considers, moreover, that presbyophrenia and Alzheimer's disease are indistinguishable, being merely different stages in the same process.

In the condition as described by Wernicke the leading symptoms were "retention" defect, that is, a defect in immediate memory, coupled with confabulation. This was followed by disorientation for place, time, and person (false recognition). Bleuler on the other hand applies the term presbyophrenia to a case showing signs of senile dementia, together with restless activity and extreme talkativeness with logoclonia. He further remarks that it is not to be separated from Alzheimer's disease. The description which he gives tallies with the modification of the clinical picture of Alzheimer's disease described by Hertz and Funfgeld.

Kraepelin on the other hand puts presbyophrenia among the actually senile dementias, and emphasizes the point that in spite of the severe disturbance of retention and memory, the orderliness of thinking is preserved to a considerable degree, also the judgment. The patient can under standwithout difficulty a longish conversation and can take in the details of events occurring around him, but is unable to make a clear picture of the deeper connection between events, on account of his memory and retention defect. Disorientation is found and confabulation is a marked symptom. There is no insight. Delusional ideas occur, and the condition ends in complete dementia.

Kraepelin doubted whether the condition which he described as presbyophrenic was a separate entity or not. In view of the small differences between the various groups that I have mentioned and the lack of histopathological differences, it is possible that all three groups—simple presenile dementia, presbyophrenia and Alzheimer's disease—may be aspects of the same process, or even stages of the same process in the order I have mentioned. But if not then it seems desirable to use the term presbyophrenia in a distinctive way and to confine it to those conditions in which in addition to the retention defect and confabulation, there is fairly orderly preservation of thinking and the relatively good judgment in small things emphasized by Kraepelin.

This then would constitute the group which has tended to be confused with Korsakov's psychosis. It has been differentiated by Nouet among others as showing in contrast to Korsakov's psychosis a very great preponderance of incidence in the female sex, a euphoric mood, lack of insight and considerable loquacity, and the absence of course of any history of polyneuritis.

The terms Alzheimer's disease and Pick's disease should be reserved for those cases in which focal asymbolic symptoms ultimately do appear. The condition described by Bleuler where it could be distinguished from Alzheimer's disease might be included as one of the agitated conditions with ultimate dementia in the presenile period described by Kraepelin.

There remain some other anxious or depressed or delusional conditions with an outcome in dementia to be differentiated, especially, from an involutional melancholia in the prolonged course of which dementia has supervened.

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Dr. T. R. Hill: Cases of presenile dementia may be divided into two groups: (1) those in which dementia is associated with a primary degeneration or destruction of neurones, and (2) those in which the symptoms are secondary to a failure of the cerebral vascular system. Mixed cases do not seem to be of much significance, if they exist at all. For example, marked cerebral arteriosclerosis may or may not be present in Alzheimer's disease, and yet the clinical picture in this disease is so constant as to produce the following remark from the experienced observer Grünthal: "If we were to describe," he says, "as a typical case an artificial average in which the chief features of every case were represented, we should get very little difference from any one case." The two groups into which cases of presenile dementia divide themselves may be compared to parenchymatous and interstitial neuro-syphilis.

In the first group of cases—the primary cases we may call them—there are (1) Alzheimer's disease, (2) Pick's disease, (3) the doubtful entity of presbyophrenia, and possibly (4) senile dementia. The plaques and neuro-fibrillary changes of Alzheimer's disease are regarded as characteristic parenchymatous senile changes, and therefore the term "presbyophrenia" is logically applicable to this disease. This is independent of the question of whether plaques, etc., are direct or secondary effects of old age. The existence of any other clearly defined clinical entity, apart from Alzheimer's disease, to which the term "presbyophrenia" can be applied, is doubtful, unless this name be given to cases of ordinary senile dementia coming on rather early. There are also individual cases of presenile dementia that fail to fall into any of the few recognized categories. This, I think, applies particularly to cases with unusual physical signs.

I will discuss a few of the salient features of the various types of pre-senile dementia—particularly those of use in differential diagnosis—without trying to give exhaustive accounts.

Although the usual age of onset in cases of Alzheimer's disease is between 40 and 60 years, a number of definite cases have been described at earlier ages—most of these between the ages of 30 and 40, but one well-known case in childhood. Some observers would not call any cases occurring outside the presenium cases of Alzheimer's disease, but this seems purely arbitrary. The problem is the ætiology of the Alzheimer changes which have been found in various toxi-infective processes, e.g., scarlet fever, disseminated sclerosis, epilepsy, and tabes, as well as in senility.

The average duration of thirteen cases of Alzheimer's disease, all examined post mortem, was four and a half years, but two cases not in this list had a duration of twenty years and twenty-two years respectively. The course is perhaps a little longer than that of Pick's disease as a rule, but is not so chronic as senile dementia. A few of the reported cases have shown a psychopathic family history, but in none has there been the definite familial incidence reported in one or two cases of Pick's disease.

The three stages into which Grünthal divides the course may be given:—

(1) Gradual loss of memory and disturbance in perception, disorientation in place, weakness, possibly epileptiform convulsions and carelessness.

(2) Complete disorientation, dull comprehension, restlessness, inability to read, write or make simple calculations.

(3) A state of extreme irritability, with paraphasia, uncleanliness, stereotypy.

In spite of the uniformity of the clinical picture in Alzheimer's disease, stressed by some observers, a good deal of individual variation can be found. As Lowenberg puts it: "Busy delirium, excitement and confusion have characterized some cases—apathetic dementia others." On the whole, Alzheimer's disease seems more characterized than Pick's disease by confabulation, hallucinatory, delusional and anxious states, paraphasia and perseveration, and by "dysarthria rather than aphasia." Aphasia, apraxia and visual agnosia, although they may be marked,

are not so constant, so early, and so prominent as in Pick's disease. If the symptoms are divided into positive and negative in the Jacksonian sense, in Alzheimer's disease, as a rule. the positive signs seem more marked than in Pick's. An incessant busyness often fills much of the clinical picture at one stage, and epileptiform convulsions are said to be not uncommon. Cases of Pick's disease with much restlessness have been described, but as a general rule the negative symptoms seem most marked. There is an insidious onset of failure of retention, recent memory, and intellect generally, and there is generally an early and equally insidious onset of marked aphasia—usually global in type ; visual agnosia and apraxia are common. Before profound dementia sets in, what seems to characterize these cases is not incessant preoccupation, but rather inertness, lack of activity, and of all interest. Many observers have stated that patients not only fail to understand questions, but show no desire to understand. Their mood is complacent; they have little wish to talk, and will remain all day inert, demanding nothing, not even food. Their vocabulary soon shows much reduction. Paraphasia, perseveration, etc., are rare, as are hallucinations, delusions, or confabulations, which when present are slight and transient. Most cases run a course of from two to three years, though some have run from ten to fifteen.

Characteristic of both diseases in nearly all cases is complete lack of insight from the earliest stages. When insight is present at all it is slight and transient in the early stages. Both diseases are remarkable for the paucity of focal physical signs displayed. In Pick's disease the one rule that seems to regulate the local atrophies is that the pre- and post-central gyri and the visuo-sensory cortex shall always be spared—thus monoplegias, cortical sensory losses, or homonymous visual-field defects are not seen. The marked aphasia of Pick's disease is obviously due to the predilection of the degenerative process for the left parietal cortex, and as the process consists of the degeneration of ganglion cells in the upper layers of the cortex the aphasia is naturally likely to be severe and global in character.

Pyramidal or extra-pyramidal rigidities are said to occur in some cases. A number of examples of familial Pick's disease have been described—with reports of post-mortem examinations—especially by Urechia and Grünthal, and it appears that Pick's disease must be classed among those conditions in which certain groups of cells in the central nervous system are destined to premature degeneration. However, the familial cases are few.

The problem of Alzheimer's disease is bound up with the problem of the nature of senility.

In distinction to these forms of presenile dementia, senile dementia (even the delusional forms) is typically a much more gradually progressive syndrome extending over perhaps a decade or more, but there is a sharp line of demarcation between the types of presenile dementia described and the second group of cases that are secondary to cerebral arteriosclerosis.

Arteriosclerotic dementia tends to be more chronic than Pick's or Alzheimer's diseases and is of course much more common. In fact, cerebral arteriosclerosis is probably by far the commonest cause of presenile dementia. In the first stage there are often focal neurological signs or symptoms, and signs of diseased arteries, though the latter may only be found in the retina. Focal symptoms and signs may consist of headache, tinnitus, hemiplegia, hemianopia, aphasia, etc., of sudden onset and may be transient in nature. Mentally, there is insidious development of failure of recent memory, of retention, and of intellect generally—this development being usually of a patchy character, e.g., retention difficulties may be most pronounced with certain names to begin with. The important feature is that insight is well preserved. A patient suffering from arteriosclerosis *comes* himself to the doctor; a patient having Pick's or Alzheimer's disease *is brought* to the doctor. The arteriosclerotic patient gives a clear account of his failing powers ; the condition is usually

painful to him and his mood one of anxiety. The other important feature of these cases is that—as it has been said—the "nucleus of the personality" is well preserved up to an advanced stage. In Pick's or Alzheimer's diseases, or in senile dementia, the personality is profoundly shaken from the start.

I will end by briefly contrasting two cases at present under observation in the West End Hospital for Nervous Diseases, the first under Dr. Worster-Drought, and the other a case of my own.

(I) C. G., male, aged 50 years. Brought to the hospital three and a half years ago on account of loss of memory and impaired power of speech. Four and a half years ago he began to stammer, to lose interest in life and to grow careless. The condition has progressed and now he suffers from profound loss of recent memory and power of retention. He lies inert in bed for hours at a time, and would not eat unless food were brought to him. At other times he is aimlessly restless. Stares into space for hours. Does not read. No initiative or interest. Mood complacent. No insight. Orientated for place but not for time. Cannot remember what he ate an hour or two before; confabulates about it. Memory for past week very imperfect. Speech slurred. Digital retention test: 183762 = 18762; 315834 = 18354. Physically, no emaciation. Some hypertonus of limbs of extra-pyramidal type. Cerebrospinal fluid: Slightly raised protein content. Signs of moderate arteriosclerosis. *Family history*: Mother died at age of 56 with gradual loss of speech and paralysis. One aunt and one uncle suffering from similar condition. Sister, aged 50, has loss of speech and memory, and power of walking is impaired.

It can be seen that this clinical story is suggestive of Pick's disease, and this is rendered more probable still by the family history.

(II) H. T., male, aged 55. Attended hospital complaining of headaches in frontal and occipital regions and stated that for two months past his speech had been slurred and indistinct, and that he had grown very forgetful, so that he had become muddled at his work. Retention tests imperfect, e.g., digital retention tests 528764 = 57628; 837241 = 837324. Insight perfect. Symptoms distressing; mood anxious. Blood pressure 140/94. Radial arteries much thickened. Received various treatments and three months later was in a state of complete remission from mental symptoms.

This was obviously an early case of arteriosclerotic dementia. The insight and the remission are to be noted.

To round off this comparison of cases I will quote briefly the first case of Alzheimer's disease described, and note how it differs from both the above cases. The patient was a woman, aged 51 years, who began with ideas of jealousy concerning her husband. Rapid intellectual weakening followed. She became disorientated; recent memory was grossly impaired, as were speech and writing. Course of disease, four and a half years. No insight. During all this time she was restless, would shout for hours at a time, tossed the bed-clothing about, called for her family, and exhibited auditory hallucinations. These latter positive signs contrast strongly with the inertness and passiveness of the first of the two cases described above.

Sir Robert Armstrong-Jones: This important subject occupies a whole section of the Lunacy Act, 1890 (Section 116, Sub-section (*d*), par. 1), which controls the decisions and conclusions of the Master in Lunacy and the Visitors; that is, as to whether the mental infirmity arising from disease or age is such that the patient is unable to manage his or her affairs, and whether a Receiver should be appointed. The patients in the cases to which I shall refer are not certified, they are dealt with under this Section of the Lunacy Act, and thus have a Trustee or Receiver appointed to look after their affairs.

We all know that a certain degree of mental enfeeblement is the ordinary accompaniment of old age. It is inevitable, and it is properly regarded as the natural involution and termination of advancing years. The condition is physiological, but it may become pathological if it is characterized by a marked loss of memory, a marked change in personal habits or conduct, purposeless restlessness

(hyperkinesis), or its opposite, extreme lethargy (hypokinesis) and fatuity, or a growing suspicion of unjustifiable antipathy and hatred towards those who were formerly nearest and dearest. When these symptoms are present they may be rightly regarded as signs of oncoming dementia, and this even before the age of 50 is attained. All these symptoms depend, however, on the "inherited and inherent durability of the neuron" in each case, and this is the postulate that must guide us in our diagnosis of presenile dementia and incapacity.

In this discussion we are excluding all the mental and physical changes depending upon coarse lesions, e.g., hæmorrhage, thrombosis, embolism and new growths, for although these occur more frequently in old people, they are not uncommon in middle life, and they are also not unknown in young persons; but the symptoms in these lesions depend upon the site of the brain injury, the lesions are coarse ones from which no age is immune, and the mental symptoms are therefore not general, but very variable.

In senile—and indeed in presenile—dementia, following upon, and in consequence of loss of memory or the power to recall recent events, there is often marked mental confusion, especially with regard to the names of friends and relations and their home surroundings, and to ideas of time and place. The patients are unable to give the names of those who are dependent upon them, or to relate the amount of their property, and as old age is conservative they tend to become penurious, and begin to suspect those who have charge of them to be plotting to rob them. For this reason their former trusted agents and servants are dismissed, and plausible time-servers ingratiate themselves and gradually get control of the patient's property. It is not uncommon for presentable and designing young women to obtain complete control of men suffering from presenile dementia, and even nurses have been known to get such patients to make a will in their favour, to the detriment of those who have natural claims of affection and kinship upon them. It is here in such cases—the patients not being certified—that the protection of the Master in Lunacy is of inestimable service to the family. I maintain that no person who is mentally enfeebled and under a Receivership order should be allowed to make a will without the consent of the Master, who exercises his discretion in the interests of the patient and of his dependants.

I need not add that some of the mental symptoms of presenile dementia, in both men and women, may relate to the sexual instincts. The moral faculties, being the latest to be acquired, are the first to go; men become troublesome with young girls, and women with boys. This is no uncommon event, and such cases may come before the Courts and cause great pain, and cast a dark stain upon innocent relations.

In the Report of the London County Council for 1914 there is a summary of all the senile admissions into its Mental Hospitals, covering a period of seven years, and only 4% of these were on account of senile dementia. Also only 4% of the total deaths in all the mental hospitals were from senile dementia. There were a few recoveries, but only a few. The condition is correctly recognized as being generally incurable.

Dr. G. W. B. James said he would take this opportunity of relating the history of a case of Alzheimer's disease which he had observed. The patient was a woman, aged 47, and was under the care of Dr. Worster-Drought. She died within three and a-half years from the usual signs and symptoms of Alzheimer's disease. Her case was interesting, because she was visited by all the members of her family, and these were all anticipating the onset of the same disease in their own persons. The patient had already lost three brothers from the disorder. Her mother had died from cerebral hæmorrhage, probably suddenly, at the age of 54, and her father was probably suffering from Pick's disease. There was now only one of

her brothers surviving; one had been killed while motoring; one had died from Alzheimer's disease and the others from some neuropathic condition.

One aspect of presenile conditions, which so far had not been mentioned, concerned the increasing number of presenile patients with profound anxiety and an apparent dementia. Such a patient complained of inability to concentrate, and maintained a fearful attitude towards any new situation which he had to face; he was anxious about his future and as to his work. From the history of such a patient it was clear that he had never before had such an attack, or been troubled by anxiety.

With regard to Pick's disease, he (Dr. James) thought that neurologists saw more cases of this than psychiatrists did. He had himself seen only one and that was during a visit to a German hospital, at which a fairly advanced case had been shown to him by Professor von Heffer.

Dr. R. M. Stewart said he thought that a good deal still remained to be written on the subject of Pick's disease. Though, perhaps, the most striking feature was the gross naked-eye change, it must be understood that, microscopically, the changes were limited to the supra-granular cortex. He had examined the brains of many aments, in whom the changes, as described by Dr. Critchley in the pyramidal cells of the outer layers, were equally striking, yet they did not show the widening of the sulci and the angularity of the gyri. That was his reason for saying that much had still to be added to the pathological descriptions.

Several years ago—before the late War—he had collected a series of brains from patients who had died in the presenium, and one feature which had struck him—and which had not been referred to in this discussion—was the marked degree of atrophy of the corpus callosum. He thought that this feature bore some relation to Dr. Critchley's correlation of certain physical signs with atrophy of the commissural and associational fibres.

Dr. Letitia Fairfield said that, with regard to Dr. James's comments, some years ago she had tried to work out the suicide rate in men and women—in connection with another matter—and she had found that the rate rose between the ages of 45 and 55 in women, and that there was a considerable rise in the case of men too, at about the same age-period. That was a matter of interest from many points of view, and increased the medical attendant's anxiety concerning patients who showed mental symptoms at about that age, even though they might not be supposed to be immediately and directly suicidal.

Another interesting point concerned the possible connection between these presenile conditions and the endocrine changes occurring at this period of from 45 to 55. One of the difficulties in considering the presenile mental conditions of women, for example, was that the age-period followed closely on the changes occurring at the period of the menopause: and it was difficult to know how much to attribute to temporary conditions, conditions which would adjust themselves, and how much to more central changes. Much the same referred to the case of men. She had noted it in connection with supervising the health of teachers and other professional women and also in the case of men. One found a great anxiety and depression as a marked mental feature at about the ages she had mentioned, and it was important that more should be known as to the ætiology of such cases than was known at present.

Dr. Macdonald Critchley (in reply) said he had been much interested and indeed surprised to have the information from Dr. Gillespie and Dr. James about the familial incidence of Alzheimer's disease, as that conception was new to him, and he believed it was new, also, in the literature. Pick's disease was now known

to be largely familial, and Grünthal had shown him in 1929 the original sections of his first cases of Pick's disease in two brothers; since then other cases had been described. He (Dr. Critchley) did not know, however, about the existence of Alzheimer's disease in psychopathic families. Grünthal himself suspected cases of supposed Alzheimer's disease occurring in young persons, and he (the speaker) would agree that such were probably not cases of Alzheimer's disease at all.

Dr. Hill had raised a difficult point, namely, as to the non-specificity of the histological changes in Alzheimer's disease, the senile plaques, etc. It was true that there was no single appearance that was specific in these presenile dementias; it was necessary to consider the picture as a whole. Dr. Hill had mentioned "senile" plaques in young subjects with other organic neurological diseases. Although this was true, the speaker did not think that should receive very strong emphasis, as they were very exceptional. When senile plaques were first discovered they were thought to be pathognomonic of presbyophrenia. That idea, however, was found to be false. Then they were believed to be pathognomonic of senile dementia. They were then described in the brains of normal old people, and some noted that they became more numerous as the person got older, so that a normal centenarian's brain looked like the brain of a dement aged 70. He (the speaker) had found very few plaques in some senile brains; but the greater the dementia in an old person the greater was the likelihood of finding these.

Though one might find no clinical signs of radial or retinal arteriosclerosis, one could not exclude the possibility of the existence of cerebral arteriosclerosis; and he thought that in a case which was doubtful clinically the odds were in favour of it being an arteriosclerotic dementia. He did not think it was possible yet to diagnose either Pick's disease or Alzheimer's disease during life.

To the clinical points which had been mentioned as suggestive of arteriosclerotic dementia he would add two. The first was remission. If the patient was taken into hospital and improved a little, that pointed to a diagnosis of arteriosclerosis. The second was the question of control over the emotions; defective control was characteristic of arteriosclerotic dementia, and not of the other varieties.

Dr. Hill had said that the pre- and post-central convolutions were not affected in Pick's disease. It was true that cases of such were not described in the literature, but Dr. Greenfield and himself had had a patient with monoplegic symptoms, on account of which decompression had been performed. At the autopsy the case was found to be one of Pick's disease, with extreme atrophy of the precentral convolutions on both sides.

Dr. Gillespie (in reply) said he did not think the suggestion that Alzheimer's disease having a hereditary factor was new to the literature, but he thought that definite figures about it were lacking. His remarks were based largely on Dr. Henderson's impressions; possibly some of the cases diagnosed as Alzheimer's disease were Pick's disease. On several occasions when he (the speaker) had tentatively diagnosed Alzheimer's disease he had subsequently been obliged to revise that diagnosis in favour of arteriosclerosis.

He was glad to hear Sir Robert Armstrong-Jones draw attention to the legal side of this question, because, from the practical point of view, that was important in the early recognition of presenile states.

In extenuation of his omission to mention sexual misdemeanours he must plead that in the cases of the conditions under discussion which he had had, the sexual aspect was not prominent.

Dr. Hill (in reply) suggested, apropos of the remarks about restlessness, that the noticeable feature of inertia and inactivity in Pick's disease was due to the intensive nature of the degenerative changes in the association areas of the brain, and that

restlessness was more marked in Alzheimer's disease as a sign that the pathological process was not so intense and so the destruction of the power of expression of impulses and of emotions was not so great.

As to the diagnosis of Pick's disease and Alzheimer's disease in contrast with cerebral arteriosclerosis, and the difficulty mentioned by Dr. Critchley, he (Dr. Hill) considered that the question of insight was the most important one. If a case, from the start, had no insight, one would give careful consideration to it before saying it was a case ef arteriosclerotic dementia. He could not share Dr. Critchley's diagnostic pessimism.

He had referred to the non-specific pathological changes in Alzheimer's disease, but all authorities seemed to agree that, clinically, the syndrome was a very clear-cut one, and so it deserved to be called a clinical entity. Professor Urechia, in correlating the post-mortem changes in many cases of Pick's disease, said that the precentral gyri were notably immune from degeneration. The case quoted by Dr. Critchley must, therefore, have been a most exceptional one.

JOINT DISCUSSION No. 6.

Section of Medicine and Section of Epidemiology and State Medicine.

Chairman—H. MORLEY FLETCHER, M.D. (President of the Section of Medicine).

[*January* 24, 1933.]

DISCUSSION ON UNDULANT FEVER.

Sir Weldon Dalrymple-Champneys: I am going to begin with an emphatic statement. Undulant fever in this country can no longer be regarded as a medical curiosity, nor should it any longer be used only as a last desperate diagnosis when all else has been disproved. Undulant fever is a definite clinical entity which, in spite of the bewildering variety of phenomena which it may exhibit, can in most cases be diagnosed on clinical grounds alone, though confirmation should always be sought from the laboratory. Some may think this is an overstatement, but if I had the time to give you an analysis of the signs and symptoms exhibited in my series of 115 English and Welsh cases I am sure I could convince you that my view is justified, and it is, I may say, shared by many physicians in the United States and elsewhere who have experience of this disease. A clinical analysis of the cases in my series must, however, await a more favourable opportunity.

World extension.—Before discussing the epidemiology of the disease in this country I would say a few words with regard to its behaviour in other parts of the world. When Marston[1] first rescued undulant fever from the rubbish-heap of irregular fevers in 1859 it was only recognized in the Mediterranean region. Though Bruce's discovery[2] of the causative organism in 1887 led to its much wider recognition in the Mediterranean islands and the countries bordering that sea, it is not till 1897—the year of publication of Hughes' classical monograph[3]—that we get a report of a case outside this area, namely from India, where Wright and Smith[4] investigated a very interesting group of cases among the officers of an Indian regiment. So far as concerns the literature of the disease, the position was practically the same up to 1910 (though according to Mohler[5], Holt[6], and others, the

1 "Report on Fever" (Malta). *Army Med. Rep.*, published in 1863, vol. iii, 486.

2 "Notes on the Discovery of a Micro-organism in Malta Fever." *Practitioner*, Sept., 1887, 161.

3 "Mediterranean, Malta or Undulant Fever." London, 1897.

4 "A Note on the Occurrence of Malta Fever in India." *Brit. Med. Journ.*, 1897 (i), 911.

5 *Report of the Chief of the Bureau of Animal Industry* (Washington, D.C.) *for the Fiscal Year ended June* 30, 1922, p. 61.

6 "Malta Fever and its Prevalence along the Mexican Border." *The Military Surgeon*, 1925, lvi, 414.

disease has been known in Texas and New Mexico since 1888), but since then its *apparent* spread has been very rapid and extensive. In my report to the Ministry of Health in 1929[1] I gave a list of fifty countries in which undulant fever had been recognized. Another eleven countries must now be added to the list and, as you will see from the map (fig. 1), its distribution can now be justly described as world wide. In the United States, where, as the result of active propaganda, the majority of the medical profession are on the look-out for the disease, the only two administrative divisions in which undulant fever has not been recognized are Nevada and Rhode Island.

Did undulant fever start from an endemic centre in the Mediterranean and spread thence all over the world, conveyed perhaps by Maltese goats long famous for their milk yield? No one can say, though it is a fascinating subject for speculation. One thing, however, seems almost certain, that in many countries the disease is

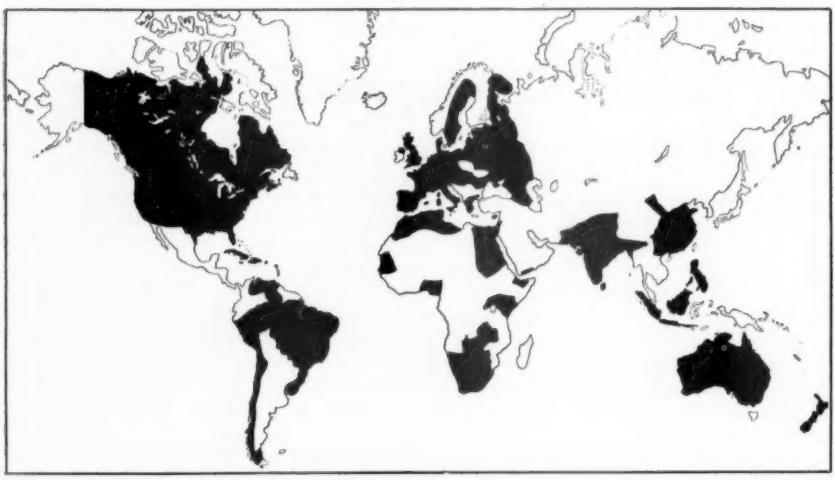

FIG. 1.

much more prevalent than the recorded number of cases would suggest, and that it existed unrecognized long before the first case was reported.

Extension in England and Wales.—When I wrote my report for the Ministry of Health in 1929 I could only find published accounts of fourteen well authenticated cases of endemic origin (excluding laboratory infections) occurring in England and Wales. Since then interest in the disease has increased very greatly and has led to better diagnosis, though I am convinced, from the intensive search I have carried out over the country during the last four years, that many cases still pass unrecognized and that others, though recognized, are never reported. Diagnosis has, then, improved so rapidly that I am able to-day to give you an account of 115 well-authenticated cases occurring in England and Wales.

English and Welsh cases by year of occurrence.—The distribution of these cases year by year may be seen from fig. 2, which shows a rapid increase in the number

1 "Undulant Fever, with Special Reference to Animal Sources of Infection and the Possibility of its Prevalence in England and Wales." *Ministry of Health Reports on Public Health and Medical Subjects*, No. 56, 1929.

of cases coming to my knowledge, but does not, of course, represent the true incidence of the disease. A closer approximation to the true incidence would be obtained if the disease were compulsorily notifiable, as it is in New Zealand and many of the United States. (The bovine disease is compulsorily notifiable in France, Germany, etc.).

American cases year by year.—Table I shows the rapid increase in the number of cases reported in the last-named country since 1922.

TABLE I.

Cases of undulant fever reported in U.S.A. year by year.

1922	...	1	1927	...	217
1923	...	0	1928	...	649
1924	...	2	1929	...	1,301
1925	...	24	1930	...	1,450
1926	...	42	1931	...	1,545

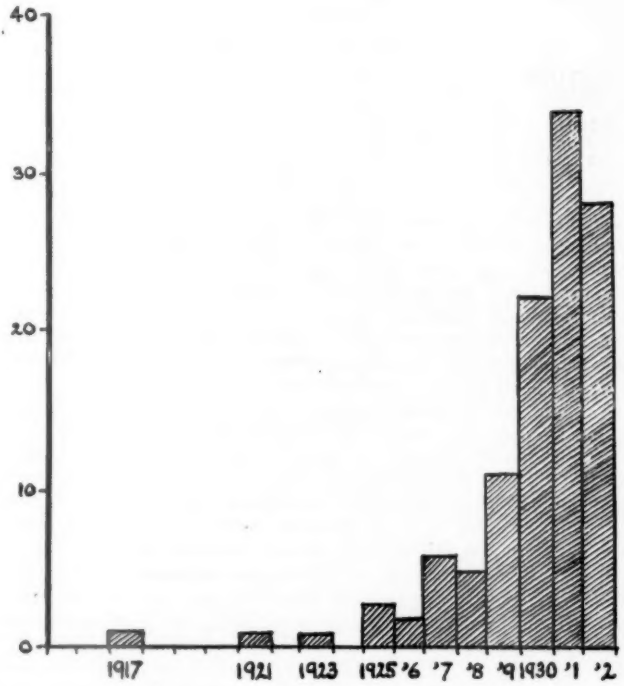

FIG. 2.—Cases of undulant fever in England and Wales.

Diagnosis of cases in the series.—Some interesting points emerge from an analysis of my series of 115 English and Welsh cases. It is obviously impossible on this occasion to give you for each individual case the evidence which I consider justifies a diagnosis of undulant fever. Generally speaking, however, the series excludes laboratory infections and those contracted abroad and includes, with one exception, only those cases in which there was fever of an irregular type, together with an agglutination titre for organisms of the Brucella group of more than 1 in 100. The only exception is the case of a man who drank raw milk from cows, the blood of

one of which was found to agglutinate *Br. abortus* to a titre of 1 in 1,000. This patient had a fever of ten weeks' duration, which was clinically typical of undulant fever.

Though it is a good working rule to require a minimum titre of 1 in 80, or 1 in 100 for the diagnosis of this disease, one should, in my opinion, be prepared to make exceptions, as a pro-agglutinoid zone sometimes causes agglutination to be missed, and cases are on record in which the patient's blood-serum failed altogether to agglutinate a *Br. abortus* grown from the patient's blood.

However, in all cases except that to which I have just referred, the agglutinin titre was at least 1 in 100 and usually much higher. The average titre was rather more than 1 in 1,500 and in 52% of the cases it was 1 in 1,000 or more.

The diagnosis was confirmed by cultivation of the causative organism in an eighth of the cases in which culture was attempted, as will be seen from Table II.

TABLE II.

Results of cultural tests.

	Number of cases	Number of positive cultures	Percentage +
Blood ...	43 ...	7 ...	16
Urine ...	24 ...	2 ...	8
Fæces ...	5 ...	0 ...	0

Distribution of cases by place of occurrence.—With regard to the distribution of the cases in this country, the necessary information is available in 112 cases, and I have indicated each case by a small triangle in the map (fig. 3). The map does not of course show the true distribution of the disease, as all cases do not come to my notice, and grouping is apt to occur in districts where there is a pathologist or medical officer of health interested in the disease. The map does however demonstrate the fact that the disease occurs in all parts of the country.

Sex of patients.—Of the 111 patients whose sex is known 73 were males and 38 females. This great preponderance of males over females has been observed in most countries where the disease has been studied and is difficult to explain. One would expect, *a priori*, that women and children would be the greatest sufferers, as they usually drink more milk than the men. In agricultural countries the phenomenon has sometimes been attributed to occupational causes, direct contact with infected animals being regarded as a more important source of infection than raw milk. This cannot however be the explanation in this country, as we shall see presently, and I venture to suggest tentatively that men, for the very reason that they consume less milk, are apt to lose that immunity to *Br. abortus* which women and children maintain by the regular consumption of infected milk and so men more readily fall victims to the infection when they encounter it. Maintenance of immunity by doses of the causative organism too small to produce clinical symptoms may also account, in part at least, for the apparently low incidence of the disease in human beings, in spite of the very wide prevalence of contagious abortion in cattle.

Ages of patients.—The age distribution of 110 patients is shown in Table III.

TABLE III.

Age distribution (110 cases).

0-10	10-20	20-30	30-40	40-50	50-60	60 +
4 ...	14 ...	10 ...	19 ...	26 ...	23 ...	14

Minimum = 20 months.
Maximum = 81 years.

61·5% between 30 and 60.

It will be noticed that the disease is uncommon in the first ten years of life and commonest in the fifth and sixth decades, 61·5% of the cases occurring between 30 and 60 years of age. This is, on the whole, in accordance with figures given for other countries, though usually the most dangerous decade appears to be the fourth rather than the fifth.

Ætiology of cases in the series.—Now let us see what indications as to ætiology we can obtain from a study of the patients' occupations and their history of drinking raw milk or coming into contact with infected, or possibly infected animals.

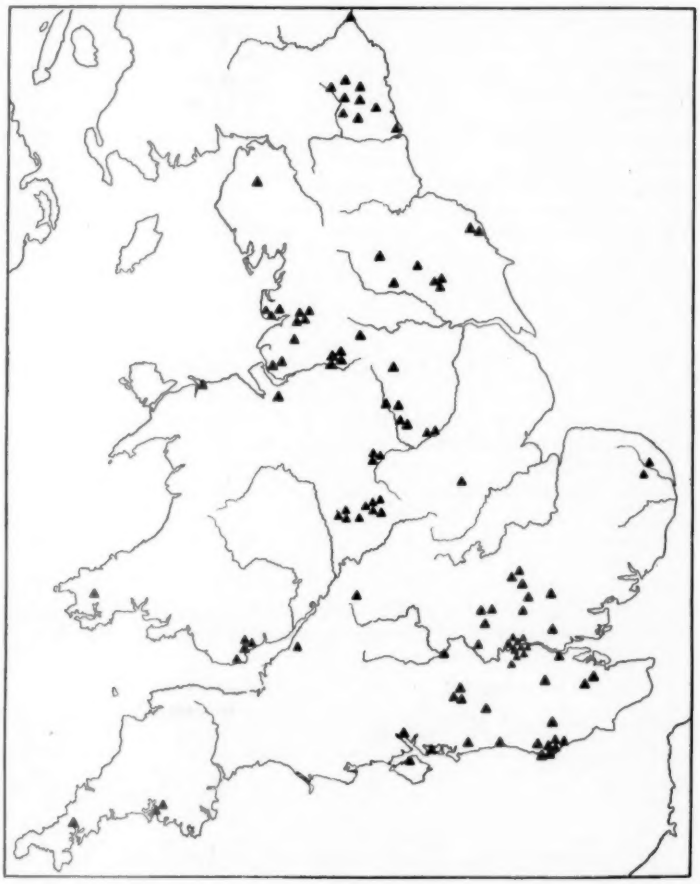

FIG. 3.

Occupations of patients.—Table IV shows the occupations of 99 patients for whom this information is available. A good many different professions and occupations are represented, but the only categories that we need consider now are "farmers and farm workers" and "other persons living on farms." These two categories together comprise 13 persons, or 8% of the whole series. This low figure

is in marked contrast to those given for other agricultural countries. Maclean [1] reports that in New Zealand 47% of the cases of undulant fever have occurred among dairy farm workers, who represent only about 5% of the total population, and he concludes that "considering the probable exposure to more or less infected milk of a large part of the general population it is evident that milk infection plays but a small role in the epidemiology of the disease." In the case of our own country the opposite conclusion seems to me inevitable, but you shall judge for yourselves.

TABLE IV.—OCCUPATIONS OF UNDULANT FEVER CASES IN ENGLAND AND WALES.

Occupation	Males	Females	Total
Farmers and farm workers	10	1	11
Other persons living on farms	1	1	2
Domestic duties	—	16	16
Office work	11	—	11
Medical practitioners	8	—	8
Nursing	—	2	2
Schoolboys and schoolgirls	5	7	12
Clergymen and priests	3	—	3
Nun	—	1	1
Merchants and manufacturers	8	—	8
Miner	1	—	1
Inmates of mental hospitals	2	—	2
Market gardener	1	—	1
Musician	1	—	1
Pharmacists and dispensers	1	1	2
Naval recruit	1	—	1
Dental officer, R.A.F.	1	—	1
Upholsterer...	1	—	1
Draper	1	—	1
Retired schoolmaster	1	—	1
Jeweller	1	—	1
Commercial traveller	1	—	1
Caretaker	—	1	1
Excise officer	1	—	1
Postmaster	1	—	1
Warehouseman (cotton yarn)	1	—	1
Golf club secretary	1	—	1
Grocer	1	—	1
Painter (and pigeon fancier)	1	—	1
Waitress	—	1	1
Gas worker	1	—	1
No occupation	1	1	2
	67	32	99

Evidence of bovine infection.—Table V sets out the evidence of infection from bovine sources in the 83 cases of my series for which this information is available.

TABLE V.

Evidence of bovine infection (83 cases).

Evidence	RM	RM CA	RM MC	RM MC B+	RM CA MC	RM M+	RM B+	RM DC	RM CA DC	RM CA M+	RM CA B+	DC	DC CA	DC CA B+
Number of cases	48	11	1	1	2	2	5	1	2	1	4	1	2	2

RM = Consumed raw (not pasteurized or boiled) milk.
CA = Contagious abortion said to be present in the herd concerned.
DC = Direct contact with bovines.
MC = *Br. abortus* grown from the milk.
M+ = Agglutinins for *Br. abortus* present in the milk.
B+ = Agglutinins for *Br. abortus* present in the blood of the cows concerned.
Total number of cases in which raw milk was consumed = 78.
Total number of cases in which there was direct contact with bovines but raw milk was not consumed = 5.
Total number of cases in which there was direct contact with bovines but raw milk was also consumed = 3.

1 "*Brucella abortus* Infection in New Zealand." *New Zealand Med. Journ.*, xxxi, No. 164, p. 262, Aug., 1932.

I am afraid the table looks rather formidable, but in view of the numerous factors involved this seemed the simplest way of setting it out. You will notice that the evidence varies very greatly in different cases, in some cases the source of infection being proved up to the hilt, whilst in others only a history of drinking raw milk (i.e., milk which had not been pasteurized or boiled) or of contact with bovines, which may or may not have been infected, was obtained. It is, however, significant that 78 of the 83 persons concerned were in the habit of drinking raw milk, whilst only eight had had contact with bovines and three of these had drunk raw milk as well.

Infection by direct contact.—I have been greatly struck by the complete absence of veterinary surgeons, butchers and slaughtermen from the series. One would naturally expect to find cases among those who handle infected animals or their carcasses and such cases have been reported from Denmark, France, Germany, Esthonia, New Zealand and the U.S.A., being particularly common in the last-named country. There is good reason to suppose that our own country is no exception in this respect. I have been told of several cases in veterinarians in different parts of the country but unfortunately even the most persuasive letters have somehow failed to elicit particulars of these cases, so that I have been unable to include them in my series. At the annual Congress of the National Veterinary Medical Association at Folkestone last year at which Professor G. S. Wilson and I spoke on undulant fever and contagious abortion, Professor Wilson took the opportunity of examining the blood of a large number of volunteers among the veterinary surgeons attending the congress for agglutinins for *Br. abortus*. Blood was collected from 98 veterinarians, 63 of whom had been exposed to contact with aborting animals, whilst 35 had had no such contact. In the first group 15 blood-sera agglutinated Brucellæ to a titre of 1 in 20 or over (six agglutinated to a titre of 1 in 80 or over) and in the second group only one positive result was obtained, the subject being a laboratory worker constantly handling cultures of Brucella whose blood agglutinated this group to a titre of 1 in 40. A control group of 30 Wassermann sera, supplied by Dr. Rosher, of Charing Cross Hospital, gave only one positive agglutination test, the titre being 1 in 20. I have no time now to discuss these results with the care which they deserve, but the author's conclusion that "veterinarians, slaughterers and farm workers frequently become infected with *Br. abortus*"[1] is, I think, fully justified.

Professor Walker Hall is going to tell you about the infection of the milk in his area with *Br. abortus*, and other speakers will, I hope, refer to the problem presented by the wide prevalence of contagious abortion among the dairy herds of this country, but I would like to say just one word about channels of infection other than milk.

Infection by indirect contact.—The handling of infected animals or their carcasses is not the only other way of becoming infected. The manure or litter of infected animals presents a real danger, which has for years been insisted upon by my friend, Dr. Lafenêtre, Director of the Veterinary Services of the Department of Herault in the South of France. In his most interesting book[2] on this disease Dr. Lafenêtre describes an epidemic of twenty-five cases, among the inhabitants of a small village, which was traced to a heavily infected herd of goats, which is shown in this photograph (fig. 4). None of the patients had drunk the milk of these goats, but the manure of the animals had been used on the patients' gardens, and the onset of the disease had occurred in each case just fifteen days after the removal of the manure to its new destination. I had the opportunity of inspecting the guilty herd in company with Dr. Lafenêtre, after they had been removed to quarantine on the mountain side (under the law which had just

1 Latent Brucella Infections in Veterinarians, *Vet. Record*, N.S., xii, No. xli, 1240, Oct. 8, 1932.

2 "Étiologie, Diagnostic et Prophylaxie de la Mélitococcie." 1930. Toulouse: J. Bonnet.

come into force) and, in spite of the failing light, I was able to obtain this photograph.

FIG. 4.

Conclusion.—This disease which, in my series of cases alone, caused four deaths and 1,113 weeks of fever, not counting convalescence, which was in many cases very prolonged, is one which deserves the very serious attention of both clinicians and epidemiologists. It is also a malady which provides a most fascinating study, often bewildering in its kaleidoscopic variety of manifestations, but for this very reason exceptionally gratifying to diagnose. And if diagnosis is not always the prelude to successful treatment, undulant fever does not stand alone in this respect, as even my most distinguished clinical friends will admit, and correct diagnosis can at any rate save the patient from much useless and unpleasant therapy.

In conclusion, may I ask a favour. Will all members of our profession make it a practice when they send blood for a Widal test to ask the pathologist to put it up against a Brucella antigen at the same time, and secondly, will they send to me at the Ministry of Health details of all cases of undulant fever coming to their knowledge (or at least the name and address of the doctor in charge), so that a true picture of the disease in this country may be obtained and measures be framed for the protection of our people from this sinister malady.

Professor I. Walker Hall said that some years ago an interest in the production of Grade A milk had brought him into contact with the frequency of infective abortion in the milking shed. In accordance with his advice the cows concerned were all isolated and disinfected, and the material examined for the causative factor. But the problem ever before them was the criteria upon which the cows could be returned to the milking herd and the milk added to the general daily output.

As time elapsed, the observations made in Denmark and Iowa suggested an extended investigation into the presence of *Br. abortus* in milks supplied to the householder.

Their first method was to inject the deposit from centrifugalized milk into guinea-pigs, and after a suitable period they attempted to isolate the *Br. abortus* from the organs of the animal. By this means they were able to demonstrate the presence of *Br. abortus* in 12% of milks marketed in Bristol. The method, however, proved slow and tedious.[1]

The daily consumption of milk in Bristol was about 18,357 gallons. Of this 8,400 gallons or 47·5% was cleansed and pasteurized; 521 gallons or 0·28% was classed as Grade A or certified; 9,436 gallons or 52·22% was market milk. Delivery was effected in bottles for 6,106 gallons = 33·2%; delivery was effected as loose milk 12,251 gallons = 66·8%.

To cope with this quantity of milk it was necessary to devise a less complicated and more rapid method of examination. The experiments were detailed elsewhere.[1] They led to the adoption of a method in which the determination of the presence and extent of the *Br. abortus* agglutinins in milk might be taken as a valid indication of an aborting cow in the herd from which the mixed milk had been obtained. On these lines the following evidence had been accumulated:—

		No.	Positive Agglutination for *Br. abortus* Per cent.
Raw Churn Milk:	Jan.-March,	100	22
	April-July,	100	30
	Aug.-Nov.,	100	27
Pasteurized Milk		21	31
Graded Milk:		27	44
(*a*) Grade A			
(*b*) ,, (T.T.)			
(*c*) Certified			

The *Br. abortus* might be found almost equally in all classes of vended milk. In graded milks the findings showed an apparent increase, but it had to be remembered that bottles of graded milk were often drawn directly from individual cows, whereas churn milk was a mixture of milk from a number of cows.

In the latter instance, it was, however, possible that agglutinins from one contributing cow in a large herd might be diluted beyond the means of ordinary demonstration.

The comparatively high percentage of pasteurized milks that contained agglutinin prompted an inquiry into the action of those milks when injected into animals. The following figures showed that in no instance could the *Br. abortus* itself be demonstrated, and that the agglutinin condition present did not produce any harmful action upon the tissues of the injected animals.

For comparison the results with raw milk were appended:—

	No. with positive agglutinations	Guinea-pig serum agglutination +	*Br. abortus* in Guinea-pig tissues
Raw Milk	28	22	20
Pasteurized	9	0	0

In an attempt to follow the distribution of the abortus-infected milk to the general population they had examined the serum of 590 healthy persons and found agglutinins for *Br. abortus* present in 7%, namely in 335 males = 7·46%; 140 females = 8·58%.

Since January, 1930, they had adopted, as a routine measure, the titration for abortus agglutinins in all serums submitted from febrile patients for suspected typhoidal infections. In the last sixty-one specimens they had found agglutinins for *Br. abortus* present in 4·9%. In these instances the clinical conditions had been indicative of undulant fever.

Observations such as these would gain considerable weight if it became the custom to test all influenza and other febrile disorders for the presence of serum Brucella antibodies.

1 *Report of the Medical Officer of Health*, Bristol, 1931.

Dr. Sinclair Miller (Harrogate) said he would describe some results obtained by treating undulant fever by protein shock.

His first case was in a man aged about 30, who came with the condition three years ago. When seen he had been ill six weeks with fever, and it had already been diagnosed as undulant fever when he saw the patient. His agglutinin titre when examined was 1 in 1,500. He looked healthy, and his physical condition was good. The doctor agreeing, protein shock was commenced, the man being given three doses at intervals of two or three days. After those doses there was no further rise of temperature, and there had been no recurrence during the time his case was followed up.

A year later he saw a doctor, who was running an undulant temperature, and had been doing so for a considerable time. He was taken into a home, but the temperature did not settle down quietly. The patient agreed to try protein shock. After it was carried out the temperature aborted, and there was no recurrence.

A third case was also in a doctor, to whom three injections were given, and he had no recurrence of symptoms or temperature.

A fourth case—in a woman—had been going on, with a recurrent temperature with remissions, for six months. When admitted to a home she had a swinging temperature. She was given protein shock, and after her second injection the temperature came down to normal and remained there. She has remained perfectly well since.

He had now had six cases of the disease, all of which had given a high agglutination titre against *Br. abortus*. One of them had required five injections, but finally—after fifteen days—the temperature had abated.

He used the ordinary T.A.B. paratyphoid material, and began with 50 to 100 millions. Dependent on the degree of reaction, he observed an interval of either three or four days. The protein shock raised the temperature to 103° F., and there occurred sweating, shivering, and general malaise. Usually the temperature began to fall after the first injection.

He did not advance this as a panacea for this disease, but, basing his contention upon these cases, he submitted that it might be tried oftener than was probably the case.

Dr. C. E. Lakin said he wondered whether protein shock was likely to be successful in Malta fever. He had had a case of Malta fever under his care last year and in spite of everything he did the fever continued. Eventually (after six months) it terminated spontaneously. The patient was an artist, who had been wandering in Spain, where he drank goat's milk. He (the speaker) supposed that cheese was another possible source of undulant fever.

Fleet-Surgeon W. E. Home said that according to his information there was no Malta fever before the Crimean War. It appeared in that island after the return of the soldiers to Malta in the men-of-war. Why did it come from the Crimea? There were recently accounts of Malta fever in Baku and Batoum, also in Rostof on the Sea of Azof, in 1930, there was a case of abortive fever which simulated phthisis and others of undulant fever.[1] Malta fever agglutinated very much as the disease under discussion.

Dr. Miller's experiences with injection of T.A.B. vaccine were of great interest. The cases at Rostof were treated by irradiation of the spleen with X-rays and all recovered. In *The Military Surgeon*, 1933, lxxii, there was an account of a case of Malta fever treated successfully with mercurochrome.

[1] *Arch. f. Schiffs- u. Tropen-Hygiene*, 1931, xxxv, 237; G. P. Rudnew & A. J. Krumberg, "Malta Fever," p. 81.

Dr. P. Manson-Bahr said he believed that he had been the first to describe undulant fever in this country as due to *Br. abortus*,[1] in a paper which he wrote in 1927. Though at that date the organism was not isolated from the blood, the circumstances strongly favoured the suggestion. He was at the time in communication with Sir Percy Bassett-Smith, who, however, did not at all agree as to the probability. As Sir Weldon Dalrymple-Champneys had said, the disease was becoming commoner. Certainly tropical disease workers were now familiar with the association between abortus and melitensis, and he considered there were no outstanding clinical differences. He had seen only six cases of undulant fever due to the melitensis organism during the last twelve years. The melitensis cases ran a longer course than the abortus on the average.

Sir Weldon asked what limit of agglutinin titre should be accepted in diagnosis. The figure for abortus was higher than that for melitensis; the former might be 1 in 2,000, melitensis 1 in 1,000. Sir Weldon had mentioned the limit figure as 1 in 80; a colleague of his (the speaker's) had contracted the melitensis infection, and the organism was isolated from both blood and urine, but he never agglutinated at more than 1 in 80. So one did not know what diagnostic limit to accept. He had seen a case of what was probably abortus fever, in a woman, with an agglutination of 1 in 30.

With regard to the spread of this disease, was it likely that cases of it had always existed in this country but had not been recognized? Or had the veterinary surgeons been unwittingly spreading the disease by wholesale preventive inoculations of milch cows with live cultures of abortus?

The Chairman (**Dr. H. Morley Fletcher**) said that the chief clinical features in undulant fever were: fever of long duration, not always of the undulant type, slow pulse and sweats. The blood-examination showed a low leucocyte count or a leucopenia. He emphasized the great importance of including the agglutination test for *Brucella abortus* when the ordinary agglutination tests for typhoid and paratyphoid were required. He suggested that it was important that in cases of persistent—though often slight—fever in children, for which no really satisfactory explanation was found, the possibility of *Br. abortus* infection should be borne in mind and agglutination tests carried out.

After the recurrent attacks of pyrexia had ceased, the patient might have for some weeks, or even months, periodic attacks of depression, sometimes of a serious nature, and if the temperature was watched, even when subnormal, it might show a periodic variation—in other words what might be called a subnormal recurrent pyrexia. A similar state of things had been described in cases of Hodgkin's disease exhibiting the Pel-Ebstein type of fever.

Dr. Geoffrey Evans reported accounts of two cases which showed the importance of watching for slight or even abortive cases. It was when the course was short that it might pass unrecognized. He stressed the diagnostic significance of sweating. The agglutination titre one month after the disease was 1 in 1,000 in one case and 1 in 1,250 a fortnight after in the second.

Dr. E. W. Goodall asked whether there was any evidence of this infection having caused abortion in women. He did not expect to hear that there had been many such cases, because the disease had not been extensively epidemic. One heard of sporadic cases but of nothing to correspond with the large typhoid outbreaks of the past.

This was not in his opinion a new disease; in his view there was no such thing as a new infectious disease. The late Sir James Goodhart had published a paper

1 "Fever of the Undulant Type in England and the Possibility of the Occurrence of *Br. abortus* infection in Man." 1927. *Archiv f. Schiffs- u. Tropen-Hyg.*, Bd. 26. Reihe D, Medicin Bd. 2.

many years ago, in the *Guy's Hospital Reports*, on what he called "innominate fever," i.e., cases of fever in which he could make no definite diagnosis. Some of these might have been undulant fever. He (the speaker) had met with similar cases which had been sent into hospital as typhoid. The Spanish priest, Orosius, who flourished about A.D. 419, had described in his "History" a pestilence which was said to have occurred in Rome about 275 B.C., in which there were so many cases of abortion in women and cattle that there was anxiety as to the continuance of both races. Whence Orosius got this information the speaker did not know, but he could hardly have invented it, though doubtless he exaggerated.

What was the relation between this disease and Mediterranean fever? Did one protect against the other? Did arthritis occur in it as he understood it did in Mediterranean fever?

In respect of the serum reactions, he was more impressed with the evidence of the clinical symptoms than with the agglutination tests.

He had tried treatment by vaccines many years ago in cases of enteric fever and had met with some good results, but had found the method very uncertain.

This discussion had given fresh proof of what he had long contended—that raw milk was one of the most dangerous articles of food.

Professor G. S. Wilson said there was considerable difficulty in the interpretation of the agglutination reaction. He agreed with Dr. Goodall that it was unjustifiable to base the diagnosis of undulant fever on the agglutination reaction alone. Five years ago a titre of 1 in 80 or 1 in 100 had generally been considered sufficient for the diagnosis of undulant fever. Since then much had been learned about latent infections, due to the consumption of raw milk and to contact with infected animals. In certain sections of the community, which were exposed to the consumption of raw milk containing *Br. abortus*, latent infections were not uncommon, giving rise to agglutinins which might cause difficulty if one of the patients developed a pyrexial attack. The only satisfactory means was to take the agglutination reaction in conjunction with the patient's clinical condition. When undulant fever was present the titre was usually high, and a titre of 1 in 1,000 or over was so unlikely to be due to latent infection that it was almost always justifiable to refer the patient's disease to infection with *Br. abortus*. Latent infections in this country, causing a titre of 1 in 100 or over, were uncommon, except in specially exposed persons, such as veterinarians and slaughterers, in whom reactions up to 1 in 640 might be encountered. In the normal population in London, brought up largely on pasteurized milk, latent infections seemed to be exceptional, and a titre of 1 in 80 or over in the presence of pyrexia of unknown origin was strongly suggestive of *Br. abortus* infection.

When dealing with lower titres one was faced with considerable difficulty in making a correct diagnosis. The occurrence of a prozone might cause trouble. He had recently had a case in which a pathologist had examined the blood-serum in dilutions of 1 in 20 to 1 in 320, and the report was negative. Clinically the case was typical of undulant fever, and when he himself had tested the serum in a wider range of dilutions, a high titre had been found; the first tube, however, in which agglutination had occurred was one containing serum in a dilution of 1 in 640.

Another difficulty concerned the antigen which was used. Strains of *melitensis* tended to go rough, and the rough antigen of this organism was not susceptible to a serum containing agglutinins against the normal smooth type. Unless absolutely smooth strains were used in the preparation of agglutinating suspensions, low titres might be obtained even in typical cases of undulant fever. Since *Br. abortus* tended to go rough less rapidly than *Br. melitensis*, it was not unusual to

find that the serum of patients infected with *melitensis* agglutinated *abortus* to a higher titre than *melitensis*.

Laboratory evidence was definite that pasteurization, as recommended in this country—145° to 150° F. for thirty minutes—killed *melitensis* and *abortus*, and extensive examination of milk which had been efficiently pasteurized had always confirmed this finding. Much of the pasteurization in this country was not carried out efficiently; the apparatus was often unsatisfactory in design and the process was not always supervised with the requisite care. He considered that, if greater attention was paid to the control of pasteurization, the risk of contracting undulant fever from pasteurized milk would be almost entirely eliminated.

Sir Weldon Dalrymple-Champneys, in reply to Dr. Lakin's remarks as to infection being carried by cheese, said that cheese was an infective medium, but only while it was fresh, the so-called unmatured cheese. The work done up to the present showed that in about a month the organism died out in cheese. Most of the cases in France due to cheese appeared to have been caused by that made from sheep's milk.

With regard to the duration of *abortus* cases as compared with *melitensis* cases, for the eighty-eight cases for which he had this information the average duration was twelve and a half weeks, with a minimum duration of three weeks, a maximum of thirty-nine weeks.

One very interesting case, which he had been seeing for some years, was that of a lady who, he believed, contracted the disease in 1886, and was still febrile. Her present symptoms were identical with those from which she had suffered in 1886, and ever since. He had seen her at intervals for the last four years, and she was still having rises of temperature to 101° or 102° F. every evening, with drenching sweats. She had had one or two intermissions, but the condition returned and probably the organism was lurking in her spleen or lymph-glands.

The Chairman had referred to the clinical characters of the disease which would justify the diagnosis. He (the speaker) had been surprised at the frequency with which hæmorrhages occurred in this disease; they were more frequent than he had at first imagined. The bleeding might take place from nose, lungs, bowel, etc. In one of the fatal cases that he had seen—in a woman—the illness had begun with severe intestinal hæmorrhage, and finally a hæmorrhage of that kind had proved fatal.

He had seen a number of patients who suffered from severe depression. A director of a well-known firm told him that during his disease he had such severe depression on three occasions that he was on the point of committing suicide.

He (Sir Weldon) confirmed what Dr. Wilson had said as to the frequency of bad pasteurization. The Chairman had mentioned the influence of the pasteurization of milk on the community. The drinking of infected milk was not, however, the only way of obtaining immunity in this disease. The production of artificial immunity was another method and one worth exploring.

In the South of France, where outbreaks of undulant fever were caused by the milk of infected sheep and goats, they had tried immunizing veterinarians and herdsmen against infection, and had had considerable success, but he did not think the immunity would last long; the immunization would have to be repeated fairly frequently.

With regard to the fall of agglutinin titre in convalescents, he had a considerable amount of information about that, and it showed extraordinary variations. One might meet with a case of very severe fever with a very high agglutination titre, and within a few weeks of the termination of the fever the agglutinins had practically disappeared. There were other cases, not so severe, in which the agglutinins after an initial fall remained at the same titre for one or two years afterwards; possibly the infection was still lurking somewhere in the body.

There were on record a considerable number of cases, well authenticated, in which the disease had caused abortion in women; in one of the cases the organism was grown from the pus on the surface of the placenta.

The only reason he could suggest for the infrequency with which cases occurred in groups was that so large a proportion of the population were immune to the disease from regularly drinking infected milk, and so did not manifest the disease.

He did not know whether *melitensis* infection protected from *abortus* infection, but probably, as the organisms were so closely allied, one would protect against the other. He knew of several cases in which specific vaccine treatment had apparently given very good results; but the disease was very irregular, and even if no treatment were given it was apt to terminate suddenly. When doctors were inclined to give vaccine treatment he advised them not to do so until the later stages of the disease, namely, when the temperature had become nearly normal; for if given when the temperature was high specific vaccines did not produce a good effect. It was not of much use to give vaccines made from old strains; besides, vaccines from fresh strains were now more easily obtainable.

Section of Otology.

President—J. F. O'Malley, F.R.C.S.

[*May 5*, 1933.]

DISCUSSION ON THE TREATMENT OF CHRONIC SUPPURATIVE OTITIS.

Mr. T. Ritchie Rodger: I would like to treat this subject as a problem, social as well as surgical. I have ventured to call it a reproach to the profession in general and to otologists in particular. Is there any other suppurating sinus which is treated with the same levity and inaction, although in no other is there inherent such an element of danger to life?

There are now some hundreds of us engaged in the practice of otology in this country, as compared with a much smaller number a generation ago, even if they were all giants in those days. Are we making such an impression on this unfortunate condition as our numbers and our combined endeavours might be expected to make? If not it should be worth while for us to take stock of the situation, and inquire in what directions our energies can best be spent.

My opinion is that we are making very considerable progress, but that this might be greatly accelerated.

We have many advantages which were denied to our predecessors. For the most part they saw only those cases which were giving rise to unusual trouble. The family practitioner was too often content to tell the patient or his guardian that the ear must be kept as clean as possible—perhaps adding that there was no danger unless the discharge ceased. Even now we occasionally meet with patients who have received this quaint advice.

The relationship between adenoids and middle-ear suppuration was not known to the people nor remembered by the practitioner. Otorrhœa was accepted as the natural accompaniment of scarlet fever and measles. There was no school medical service to hunt up the discharging ears and direct them to the otologist; and the acute ear, which is the origin of the chronic ear, received little or no attention.

We have now a more enlightened public and the co-operation of practitioners who have had diseases of the ear definitely included in their curriculum. We have a school medical service, and in most areas aural clinics attached to it. We have more careful treatment of the exanthemata, which is probably leading to a gradual diminution of the number of cases of otorrhœa arising from these diseases. It is possible that statistics under this heading may soon show an even more marked improvement. Dr. Stanley Banks has kindly given me permission to quote from his paper, shortly to be published, on "Further experiences in the treatment of scarlet fever with intravenous antitoxin," in which he states that the incidence of suppurative otitis media among the intravenous series of 1,204 cases treated during the years 1928-32 was 0·9%. The corresponding figure for 285 non-serum-treated cases in 1927 was 6·77%.

Mr. Mason Leete, of Hull, who has not yet instituted the routine use of serum, allows me to state that his percentage incidence in 1931 was 6·36, in 1932 4·37. He has so far used the serum only in severe cases, but expresses the opinion that the clearing of the throat symptoms is so remarkable that in these cases many ears must have been saved.

On the other hand, in our generation it would seem that recurring epidemics of influenza have produced a larger number of otorrhœas from that cause, than fell to our predecessors, although possibly a smaller proportion of these reach the chronic stage.

The most direct answer to our question as to whether we are making progress in our endeavour to eliminate the chronic discharging ear would obviously be a comparison between the number of such ears at present with the number at some previous date, but this is impossible. I catalogued my case sheets for 1920—the first complete year of my department at Hull Royal Infirmary—and found that the chronic ear cases were 14% of all cases seen. In 1932 the percentage was 10·5. The department, however, had grown and the actual number of cases of chronic ear discharge had trebled. In 1926, moreover, we had inaugurated aural clinics in connection with the school medical service, and in 1928 a special department under my care was instituted at the Victoria Hospital for Children. Putting the figures together, all I can claim is that about ten times as many chronic ears received expert attention in 1932 as were seen by a specialist in 1920. I have no doubt that this is typical of what has happened all over the country. It means that we have got to grips with the problem but does not tell us how far we are making headway. We have gathered under our care the material with which our predecessors had not the opportunity of dealing. We are now being given the chance to solve our problem.

There are other ways, however, of estimating our progress besides the mere numerical calculation of cases seen.

The average length of treatment is a better criterion, and here we find distinct encouragement. It is impossible to produce comparable statistics, but in one of our school clinics a reliable nurse who has been in the service for fifteen years, states that the improvement is remarkable. The attention to adenoids and the substitution of the dry treatment of the ear for the repeated syringing formerly in vogue have shortened the average period enormously. The old type of case with discharge running down the lobe of the ear, foul-smelling and excoriating, is never seen now, and the aural polypus has become much more rare.

The increase in the number of mastoid operations we may quite properly claim as an index of progress, although our critics might call it only an evidence of our enthusiasm for surgery. Where chronicity has already been established and a detailed intensive conservative treatment has failed, every dry ear achieved through operation must surely be counted a victory in our crusade. And every successful Schwartze operation performed in the acute or subacute stage, when non-operative measures have failed, can be claimed as a chronic otorrhœa prevented.

Perhaps the most searching test of all is to ask whether we have reduced the number of intracranial complications arising from mastoiditis, and with this point I wish to deal at greater length.

Here again statistics are apt to be misleading. The otologist has so recently gained his proper position in most cities and towns that a decade or two ago a large proportion of these complications passed into the hands of the general surgeon. It follows therefore that the *absolute* number of such complications in an area may quite well be reduced in the present year, even if the otologists for the area deal with a larger number than fell to their lot say ten years ago.

Again, the *comparative* number of complicated cases occurring in one's own series of mastoid operations is likewise misleading. If we operate more freely in the early stages than did our predecessors, the number of uncomplicated cases is thereby increased and the ratio of complicated to uncomplicated cases is altered even if the former do not diminish in actual numbers.

Making due allowance for these difficulties in the calculation, however, I am convinced that in recent years we have reduced the incidence of complications. Some statistics from my own practice show the trend of the change, although I submit these with due respect for the pitfalls I have already indicated.

In the first fifty mastoid operations of all kinds which I performed in Hull, I had seventeen intracranial complications, including in this term, as is usually done,

not only brain abscess, meningitis and sinus thrombosis, but also perisinous abscess and extradural abscess of the middle fossa. The explanation of this high ratio—34% of complicated cases—is that no special department had previously been in existence in the city and the general surgeons received for the most part only those cases in which immediate operation was urgently required. This state of affairs continued for a short time till the new department became known. At the Naval and V.A.D. Hospitals, where I was also in charge of the ear cases, my instructions were that I should not operate on chronic ears unless some urgent symptom had supervened, the authorities taking the view that a man who had been content as a civilian to put up with the inconvenience of a chronic ear discharge for years, had no right to ask to be excused two or three months of service in order to have his slight disability removed.

Compare this with the twenty years series compiled by Dr. David Maxwell from Turner and Fraser's clinic, in the Edinburgh Royal Infirmary, published in the *Journal of Otology* in February, 1929,[1] and having reference to the years 1907-1926. In this series also the Schwartze operations, radicals and modified radicals are taken together and the percentage of intracranial complications works out at 11·6 (276 complications in 2,369 operations).

I have analysed my cases for last year, 1932—my own cases and those of R. R. Simpson, who is associated with me in all my appointments. At the Hull Royal Infirmary, where our department is smaller than the Edinburgh one—but similar in that it deals with patients of all ages—taking all our mastoid operations together, the percentage of complications was 10·5. There is this difference, that whereas in the Edinburgh statistics the radical operations exceeded the Schwartze's by 2 to 1, in ours they are almost equal, 1·15 to 1. This would seem to indicate that in Hull we had had an opportunity to interfere earlier while it was still possible to save the contents of the middle ear. I fully expected that the Edinburgh figures for 1932 would show the same tendency, as in that city also the otologist would now be benefiting from the increased attention paid to otitis media in the schools and in general practice. In the first half at least of the twenty-years period referred to, such improved conditions would not exist. I accordingly wrote to Mr. J. S. Fraser asking if he would be good enough to have his cases for 1932 abstracted, and he kindly furnished the figures, which prove my surmise to be correct. His percentage of complications was the same as ours, 10·6%, while his ratio of radical and modified radical to Schwartze operations had altered, and instead of being 2 to 1 was now 1·13 to 1—mine being, as already stated, 1·15 to 1.

At the Children's Hospital in Hull, as one would expect, the proportion of complications was smaller, 4·2% as compared with 10·5 at the Royal Infirmary, In private cases of all ages it was 7·1%. The investigation brought to light one very weak link in our arrangements and steps are already being taken to remedy the defect. At our two municipal hospitals, otherwise well equipped, there is no ear department. We have been called in by the medical officers only when the question of operation arose. Here the percentage of complications in 1932 was 45·4—even worse than my figure of 34% fifteen years ago.

I am conscious of the imperfections of these statistics—they are in some respects a comparison of things which are not strictly comparable. There is, however, such a wide divergence between the figures from departments in which we have a well organised control over the cases at all stages and the figures pertaining to that part of our activities in which we have had no such control, that I think I can safely claim that they indicate progress in the reduction of complications.

Let us now consider the principles which should guide us in our attempt to diminish still further the number of chronic discharging ears.

1 *Journ. of Laryngol. and Otol.*, 1929, xliv, 105.

Consideration of the acute ear is not, properly speaking, within the scope of our discussion but must be included under the heading of prevention, since every chronic otorrhœa begins as an acute infection, and every acute infection must be looked upon as a potential chronic one. It may quite fairly be said that the chronic ear is mainly due to mismanagement of the acute stage, although to say so is not necessarily to impute blame to the otologist or to the family practitioner. The patient is the most frequent defaulter. The otologist should aim at keeping in touch with every case till the ear is dry: the patient and the practitioner should be pointedly advised against allowing the case to drift indefinitely into the chronic stage. In spite of some recent questionings, I think most of us are agreed as to the advisability of myringotomy if we have an opportunity to perform this before rupture occurs. Nature's method of relieving the pressure of pus in the middle ear is by sloughing of the membrane and we have no control over the size or site of the perforation which ensues, so that it may be too extensive for easy healing or badly situated for efficient drainage. The linear incision of a well-performed myringotomy practically never fails to heal when its purpose has been served. If adenoids are present I quite frequently remove them when doing the myringotomy ; the operation does not add to the patient's discomfort provided that the tonsils are left untouched. If there has been mastoid tenderness, and if this persists after myringotomy or spontaneous rupture the question of a mastoid operation will arise. In one sense these are not the least fortunate cases, as we find that nearly all of them have a dry ear and normal hearing in a very short time. This class does not swell the numbers of chronic otorrhœas, but rather that class in which evacuation gives immediate or early relief from the acute symptoms and the ear is allowed to go on discharging indefinitely. The patient has recovered his tone and his parents their equanimity; the practitioner has ceased to be anxious and the case is allowed to drift into the chronic stage.

We should impress on the practitioner and on the patient or his guardian, at the beginning of the case, that if the discharge continues beyond a certain time-limit, even if all other symptoms have disappeared, operation will have to be considered, for the saving of the hearing and the prevention of chronicity with all its inherent dangers. Whether our time-limit is four weeks, or six, or even longer, is not so important as the having a limit and making an attempt to adhere to it. What is likely to happen is that before operation is finally agreed to we shall get an opportunity, if we have not already had it, of taking the conservative treatment into our own hands for a final trial. This should be aimed at every time. I shall refer later to the fact that of chronic ears, of all lengths of chronicity, different authorities claim at least 50% of dry ears by various forms of detailed conservative treatment. It follows therefore that if the otologist can get an opportunity of himself treating the drifting acute case, he will very often succeed where the practitioner and the patient have failed. If he does not succeed he should then press for operation, urging as his reason that elimination of the mastoid infection at that stage is almost certain to be followed by early resolution of the infection in the middle ear with complete restoration of hearing, while delay will probably lead to such permanent damage to the middle ear that nothing short of the radical operation will suffice.

In this matter we must not hesitate to assume the rôle of guide to the medical attendant. He expects it of us. He has not had the personal experience of the tragedies of neglected cases which have impressed us. The average mastoid experience of a practitioner is probably about 1·5 cases per annum and he probably does not see once in eight or ten years in his own practice the intracranial complications which make us so much alive to the importance of timely operation. Even when such a case does occur it does not give him the sense of humiliation which comes to us when we have to admit as an emergency a case which we had seen and put on our waiting list perhaps two months before.

In dealing with the chronic case as such—that is, the case in which chronicity is already established when it comes under our care, the same principle should be followed. The patient should be told that we are going to make a determined effort to get the ear dry by conservative measures, but that if we do not succeed within a reasonable time-limit we must assume that there is some deeper mischief and that operation will be necessary. Here, more particularly than in the acute case, it is our duty to advise the patient of the element of danger latent in every chronic ear suppuration. He has probably been impressed only by the annoying discharge and the defect in hearing: he must be told of the danger to his life. The fact can be stated plainly enough without any appearance of seeking to frighten him.

With certain exceptions, such as the case of the large anterior perforation with slight mucoid discharge, obviously tubal, the rule should be that "every discharging ear which cannot be made to cease discharging by careful conservative treatment within a reasonable time, ought to be subjected to operation." But the radical operation, which is the only one indicated in a large proportion of these cases, is not an operation which any of us are inclined to do unnecessarily and the otologist who enunciates and tries to carry out such a rule can be relied upon to strain every endeavour to achieve a dry ear by conservative means.

Few otologists would wish to have their reputation founded on the radical operation. We can promise nothing in the matter of improvement in the hearing, although it frequently occurs; it is a destructive operation as far as the middle-ear contents are concerned; the upper end of the Eustachian tube, though thoroughly curetted, may not behave well in the matter of cicatrization, and we may be left with a moist cavity, and however true it may be that, having excavated the danger area, we have removed in large measure the risk of complications, the patient will be disappointed by the failure to obtain a permanently dry ear.

Most of us would rather be judged by our Schwartze operations in acute cases than by our radical operations in chronic cases; and it follows, as I have just said, that the more we consider it our duty to advise operation when other measures have failed, by so much the more shall we be prepared to spare no pains to achieve success by conservative means.

In my experience over 50% of cases, even of considerable standing, respond to conservative treatment. J. S. Fraser and others give a similar percentage.

Of the different methods of non-operative treatment I, personally, prefer the dry treatment after a thorough preliminary cleansing. The ear is first syringed in order to clean the meatus. The middle ear is then thoroughly irrigated, a Hartmann's cannula being insinuated into the perforation or against it. When the return flow has become clear the ear is mopped quite dry. The patient is then made to inflate the ear by Valsalva's method while the surgeon holds a final mop in readiness to catch the moist bubbles, until the escaping air has a dry sound. When the ear has been thus thoroughly cleansed and dried the inner part of the meatus is filled with fine boracic powder blown in by an insufflator. In some cases small granulations or polypi may have first to be removed, and in these cases the prognosis is not so good, although many do quite well. Search must also be made for any nasal or nasopharyngeal conditions which might militate against our success, and these, if found, must be rectified. In quite a fair proportion of cases the ear remains dry after the first treatment. It would seem that in these cases some inspissated material has been lodging behind the lip of the perforation and acting as a foreign body. The patient is instructed to return whenever the powder becomes moist, when the same procedure is followed, but it is wise to give him an appointment for two weeks later in any case, as there may be moisture without his being aware of it. A large perforation may not heal, but if the ear remains dry for a considerable period, it may be assumed that the suppuration is confined to the middle ear, and any recurrence is confidently tackled in similar fashion.

The cases must be regularly reviewed by the surgeon himself and if satisfactory progress is not being shown within a reasonable time, operation should be advised. Consent is more easily obtained if we have taken the precaution to explain at the commencement, as already emphasized, that all this conservative treatment is undertaken with a view to avoiding operation, but that if it fails, operation will be necessary.

To obtain consent, it is legitimate and proper to explain that since all this careful treatment has been unsuccessful it may be assumed that without operation the ear will go on discharging for the duration of the patient's life—and further, that the patient will be handicapped in the labour market, as there is an increasing tendency on the part of employers to exclude candidates with discharging ears. To patients of the more educated class we may also mention that all branches of the Civil Service, and all employments, such as banking and teaching, in which superannuation schemes are in vogue, are almost closed to a candidate who has otorrhœa. Life insurance is also made more difficult.

Time does not permit of my dealing with the different operations and the merits of the many modifications of the radical. The modifications are all designed with a view to conserving as much as possible of the middle-ear contents, and for that very reason cessation of the discharge is less certain than with the radical operation. When I have recourse to any of these methods I am in the habit of explaining that this is still another stage in the conservative treatment, with a view to preserving the hearing as far as possible, but that the complete operation may yet have to be performed.

In conclusion, let me say that I do not pretend to have added anything in this paper to the detailed methods of treating the chronic ear. What I have tried to do is to present a comprehensive view of the subject and to indicate the general principles which should guide us. I am confident that working on some such lines as these, we may expect to see a great diminution in the number of chronic discharging ears, and so help to remove what I still hold to be a standing reproach to the profession.

Dr. A. R. Friel: The factor which keeps up suppuration, and is common to all cases, is infection of the exudation or secretion by micro-organisms.

When a series of cases of chronic otorrhœa is classified by taking into account the position of sepsis and presence of any other factor it will be found that sepsis, confined to the tympanum, and without any other factor, such as granulations or polypi, forms the largest group. In this class the area of sepsis is usually accessible. Suppuration, due to tympanic sepsis, would appear to be a condition suitable for treatment by antiseptics applied directly to the surface. Tympanic sepsis affords an excellent test for antiseptic treatment.

In the treatment of tympanic sepsis by zinc ionization, the ear is first cleansed and a weak solution of a zinc salt is inserted into the meatus. An electrode connected to the positive terminal of a rheostat dips into the solution, while the negative electrode is applied at a distant part of the body.

Consider the part played by the current. It makes the positive ion (zinc) travel towards the negative electrode, so that the film of infected material adhering to the surface of the tympanum is penetrated and permeated by the zinc, as well as the superficial cells of the mucous membrane. The introduction of the zinc takes place sufficiently rapidly for the treatment to be carried out in a reasonable time. The action of the current is selective, as positive ions alone are introduced here. No action on the tissues results from the presence of negative ions in the solution, for they are not introduced.

Consider the part played by the zinc: It is the antiseptic agent. It combines with albumin to form a dense insoluble precipitate between the subjacent tissues

and the exterior. This antiseptic layer is not only a protective, but is a bad culture medium, and the micro-organisms present die. The zinc ion, when it has combined with albumin to form a precipitate, does not diffuse. Its action is confined to the depth to which it has been introduced and subjacent tissues are not irritated.

When the current is turned off and the solution has run out of the ear it is well in those cases in which the tissues were previously much congested to blow some boracic powder into the meatus. This prevents reinfection of any mucus or serum poured out while the congestion rapidly subsides.

The test of the treatment is the clinical result. The majority of cases in which the area of sepsis is accessible, and in which no other factor besides sepsis is present, cease to discharge after one treatment.

When other factors besides sepsis are present they should be removed before ionization and when the area of sepsis is only accessible with difficulty, special means must be used to gain access to it. When the area is totally inaccessible it must be made accessible by operation.

Mr. T. B. Layton said he thought that Mr. Ritchie Rodger was not quite fair when he said that chronic suppurative otitis was a reproach to the medical profession in general, and to the otologist in particular. They did their best to improve the matter, but seeing that this was, as the opener pointed out, a social problem, the hygiene of the factory, of the school, and, above all, of the home, were the most important factors, and the reproach, if any, must rest with the nation as a whole.

Mr. Ritchie Rodger had not defined "chronic suppuration." He (the speaker) considered that an otitis had become chronic when a second organism had gained entrance, and he believed that this had usually happened by the end of two months.

He disagreed with the view that Nature's method of relieving intra-tympanic pressure was by sloughing of a part of the membrane. That might occasionally happen, but usually the perforation caused by Nature was very small, and there was no sloughing. The change from this to the large perforation was due to ulceration round the edge. It was therefore a race against time to get the acute ear well. The most important part of the treatment was to clean the meatus before the drumhead had ruptured in the acute stage. The cleansing of the meatus—under an anæsthetic—from all "débris," epithelium, &c., and anything which harboured secondary organisms, was one of the most important preliminaries of paracentesis.

He did not agree that it did not matter what time-limit was set. From the first a time-limit should be set; he thought it should be one of a month, allowing a fortnight for determining the operation before invasion by secondary organisms. The significance of this was shown when comparing the good results of the modern simple mastoid operation performed early, and the disappointing results from the same operation when once secondary organisms had invaded the mastoid region.

He agreed with Mr. Ritchie Rodger as to the risks later in life from the chronically infected ear, though he did not think it was possible to estimate what these were. He thought that the question of the radical mastoid operation had been fairly dealt with except that Mr. Ritchie Rodger had not sufficiently emphasized the risk to life from meningitis due to this operation, a risk not attached to the simple mastoid operation, which one could advocate for cases of acute otitis media in which the condition threatened not to clear up.

The opener seemed to imply that though the running ear was a detriment to a man in the labour market, after a radical mastoid operation the detriment no longer existed. He (Mr. Layton) had found that in many walks of life, having undergone a radical mastoid operation was a definite bar to employment, even when the result had been clinically perfect. Many persons who had undergone that operation could never return to a dangerous trade.

Sir James Dundas-Grant said he thought that not sufficient stress had been laid on the difference between the postero-superior (marginal) and the antero-inferior perforation. The former was almost synonymous with cholesteatoma. A recent work by Professor Portmann confirmed all that he (Sir James) had long said about cholesteatoma. The antero-inferior perforation was comparatively benign; it indicated a slighter trouble, in which the discharge came from the upper part of the Eustachian tube, and recovery would sometimes follow Eustachian medication in even obstinate cases. He had shown at a meeting of the Section a patient who had an extensive perforation, about to undergo a radical mastoid operation. He stopped the discharge by injecting chloride of zinc solution into the Eustachian tube as this could be done through a Eustachian catheter with or without a Weber-Liel tube. In one very marked case the mucus in the tympanum was so inspissated that it was almost a foreign body, and after removal by syringing and suction it recurred again and again, until he used forcible irrigation with bicarbonate of soda through the Eustachian tube. This, however, could only be carried out safely when there was a very large perforation.

Polypi sometimes grew from the edges of the perforation, and might remain inside and become larger than the perforation itself. In one case he had been able to force out the polypus by means of vigorous politzerization and snare it away; then, under ordinary treatment, the discharge had ceased, and there had been no recurrence.

Another serviceable method of treatment was with a fine galvano-cautery point, with which he had put an end to small polypi which were keeping up a discharge. In desquamative conditions particularly, he recommended the use of a modification of the late Sir William Milligan's inter-tympanic syringe, which had a U-tube attachment into which a little spirit could be sucked and then blown into the attic.

Mr. Douglas Guthrie said that he would deal with this subject in relation to (1) the Army; (2) hospitals for children.

(1) In the Army, suppurative otitis media had been, and was still, one of the commonest causes of the rejection of recruits, and of the invaliding of those already serving. He saw all doubtful ear cases in recruits in Scotland, and he did not hesitate to reject any recruit who suffered from chronic suppurative otitis, and even cases of dry perforation. That, he thought, was sound practice. Consideration was naturally due to the soldier who had served for some years, provided the ear condition was not a constant source of trouble, but it was of no use to perform the radical mastoid operation in Army cases, because it did not render the man really fit. He agreed with Mr. Layton that the man who had undergone the radical mastoid operation was at a discount in the labour market and he was equally so in the Army.

(2) With regard to the problem in Children's hospitals, in the *Journal of Laryngology* for 1926, there appeared the results of an investigation into 500 cases of aural suppuration, acute and chronic. He, the speaker, had endeavoured to follow up 500 cases collected over a period of years, allowing a period of two years to elapse before doing so. 345 were traced. Among all the chronic cases there was only one with intracranial complication, that of a boy aged 9, with cerebral abscess. In the acute cases there were intracranial complications in from 3% to 4%. It was found that 60% of chronic suppurative otitis media cases were cured, the ear being dry, and deafness slight. Five patients had died (three from pneumonia, two from meningitis, probably otitic).

By following up the cases, he had collected those which had not been cured by conservative means, and he had then instituted more thorough conservative treatment or had performed the radical mastoid operation. The results of this operation were discouraging, and since that time he had performed very few radical mastoid operations

in children, e.g., only one in the Royal Hospital for Sick Children during the last two years, although he had about 60 cases of Schwartze's operation in the hospital per annum.

He agreed with Mr. Ritchie Rodger in insisting upon great care in the conservative treatment. It was of no use to ask the mother, or nurse, to carry it out; the otologist must do it himself, or instruct a skilled assistant to do it, inspecting the ear at regular intervals.

He, Mr. Guthrie, had recently taken up ionization, and the results had been distinctly encouraging. It required meticulous attention to detail, and a fair degree of skill.

The method of washing out the Eustachian tube by catheter or Weber-Liel tube described by Sir James Dundas-Grant, was well worth trial and might be done in some cases in which it was necessary to remove adenoids. The child being in any case under an anæsthetic, the Eustachian catheter could be passed and the middle ear washed out from the nasopharynx.

Mr. L. Graham Brown said that he desired to associate himself with the plea of the opener for earlier mastoid operation in cases of chronic suppuration, i.e., after a certain time-limit had elapsed and cleansing and ionization had failed. He also agreed that in most of the cases the ordinary Schwartze operation sufficed. In selected cases of long-continued suppurations, he performed the operation of transmastoid atticotympanotomy, introduced by Charles Heath thirty years ago, and subsequently modified. It was a rational method of inspecting the middle-ear contents in every case, and it was a conservative method, in that the membranous wall of the meatus was kept intact, and the other anatomical details were preserved as much as possible, as well as the function of hearing.

Mr. James Adam said that for many years he had used the galvanic cautery for occlusion of the Eustachian tube in the radical operation.

He suggested that one cause of the frequency of suppuration in the ear in bottle-fed sucklings was the practice of turning the children on their back. In a record kept at his request by Dr. Kerr, in Stobhill Hospital, out of 200 children 175 bottle-fed, 7 had discharging ears, while of the remaining 25 breast-fed ones none had discharging ears.

Dr. Sophia Jevons said that what was needed was propaganda for the medical-minded lay public, for if progress was to be made it was necessary to come into the open and explain the possibilities of cure. She felt sure a great improvement would follow. It might be well to form a Committee of the Section for this purpose. She always found great difficulty in making the working-class mother realize the danger to her child of chronic otitis media.

Dr. Ritchie Rodger (in reply) said that it had been interesting to hear Dr. Friel speak on his particular subject of ionization; he (he speaker) had tried it, but had failed to secure the same good results as Dr. Friel did. He preferred the well-known dry treatment which he had detailed in the paper. It was essential to get the ear quite clean and dry before commencing the treatment. The wall of protective powder should be left in until it began to break down of itself. Probably Dr. Friel and he obtained their good results in the same type of case, namely, where the suppuration was confined to the middle ear. If the suppuration involved the antrum and adjacent cells he did not think that any conservative treatment would succeed.

With regard to the points which Mr. Layton had raised as to a secondary organism being the cause of the chronicity, he did not agree with that idea; he considered that it depended on the point which the infection had reached, whether there was one organism or several. He always pointed out to the practitioner in charge of the case what were the principles on which he worked. The presence of mastoid tenderness at an early stage did not necessarily mean that there was an infection of the mastoid process, but only that there was a congested condition. Older physicians used to speak of a "determination of blood" to the part. All the forces of protection were directed to that particular spot; it was the "congestion of traffic" in the circulation which caused the initial mastoid tenderness. If myringotomy was performed, or if Nature produced a spontaneous rupture, the congested condition should disappear in about forty-eight hours. If it did not, one could assume that actual infection of the mastoid process had occurred.

[*Other papers read at this meeting will be published in the next issue of the* PROCEEDINGS *of the Section.*]

Section of the History of Medicine.

President—R. O. Moon, M.D.

[*March* 1, 1933.]

Occupational Diseases.

A Historical Note.

By James Kemble, Ch.M., F.R.C.S.

(*Abridged.*)

We must all work, if not at the imperative commands of our stomachs, which would otherwise go empty, then at least at the request of our souls for contentment. There are some individuals, indeed, who consider that life, pruned of certain luxuries, becomes an ordeal, and they, I hope, are prepared to work in order to acquire the extra means needed to indulge their pet foibles. Those who do no work at all die from the want of it. Whatever our disposition may be, however, it seems that our occupations constantly expose us to disease, and often constitute very important factors in compassing our destruction.

Now, in what ways do particular callings take toll upon their devotees? Ramazzini, "Professor of Physick" at Padua, wrote the *Treatise on the Diseases of Tradesmen* which was translated and published in England in 1746, and his book has become a classic of its kind. He himself was a physician not only of acute observation, but also of most tolerant understanding. Amongst his tradesmen he includes every manner of person from washerwoman to divine. Occupations and modes of life alter with the years, and yet some of the observations made and the principles followed by men in the eighteenth century may still point a moral in the twentieth. Ramazzini says that chemists are poisoned in slow degrees by inhaling and handling the chemicals they mix. Workers in metals, such as copper and tin, and potters, who put lead in their porcelain, suffer from metal-poisoning. Painters are always sickly and not long lived, owing to the same cause. Glass-makers and glass-grinders are similarly afflicted, and they, owing to their going from the great heat of their furnaces out into the cold, also develop chest troubles, pleurisy, asthma and coughs. They have great thirsts, and for this they are advised to drink more wine, since cold water taken when one is heated causes sudden death.

Workers in "Lime and Plaister of Paris" inhale and assimilate the dust, and thus contract difficulty in breathing, dryness and roughness of the throat, and costiveness; and "their Faces are discoloured so as to resemble the Substances in which they work." Nor, it seems, should these workmen derive any consolation in their suffering from the contemplation of the products of their labour; at least not those of them who model images and statues in the said plaister for adorning churches, great halls and libraries. For the poet Juvenal deprecates this exhibitionism and "Lashes the rich unlearned Crew, who, to gain a Reputation of Learning among the Vulgar, adorned their Libraries with Effigies of the Philosophers." His own words are: "*Indocti primum, quanquam plena omnia Gypso Chrysippi invenias.*" So that whether you be a high-brow, who without deploring the epithet of "rich," would strongly resent being called "unlearned," or a low-brow, who reads gospel truth in anything written in Latin, you will, if you wish to escape this accusation of being one of the *Indocti*, take the hint and forthwith purge your library of its plaster casts of Plato, Aristotle and Bacon—and, I suppose, of its pictures of Goethe, Gladstone and Beethoven too.

Fullers, or as they are commonly called to-day, dyers and cleaners, used urine as the chief chemical agent for their work. The ancient fullers placed urine-barrels in the public places in order to collect their supply, and it was Vespasian who first levied a tax on each barrel; hence the polite French name for a public

urinal *Vespasienne*. The rolling drunkards of the town were at a premium, for it used to be said of them: "There is no Pitcher in the Lane which they do not fill, for their Bladder is always full." Owing to the disagreeable ammoniacal atmosphere in which the fullers constantly carried out their occupation, they were found to become subject to coughs, fevers, and enlarged glands in the groins and neck. But, on the other hand, since urine was at that time considered efficacious in the treatment of gout—as well as of many other disorders—fullers were said to be wholly immune from this complaint. Emetics were recommended for their coughs and fevers, also purges, bleeding with caution, and above all frequent baths to cleanse the skin and promote perspiration through the pores. Many of the eighteenth century physicians declared that "sick People must not change their Shirts or Sheets for fear of becoming thereby weaker;" but Ramazzini flatly condemns this, especially for the fullers, and says that "upon all Holy-days I would advise them to wash themselves at Home in sweet Water and walk abroad in clean Linnen."

Hippocrates wrote: "Air is at once the Author of Life and of Diseases." Fetid atmospheres are spoken of in several books of the eighteenth century as accounting for the illnesses of many workmen. The "Bearers of Corps" were subject to "malignant Fevers, sudden Death, Cachexies, Dropsies, suffocating Catarrhs, and other dismal Distempers," due to their going "down to foul Vaults full of half-rotten Corps." "They have always a wan, cadaverous Countenance, as if they were already fit for the grave." Ramazzini gives them various pieces of advice in prophylaxis, and waxes eloquent in a denunciation of the custom among princes of preserving the bodies of their families in vaults; he advocates the universal adoption of what he calls the poor man's burial, under the earth. In many places he shows a remarkable prescience of some of our modern principles of sociology, but he did not advance so far as to acclaim the advantages of cremation. He had a very tender regard for the undertakers, for he admits that "it is but reasonable, since the Bearers and Funeral-officers hide under the Ground the Corps of the Deceased, together with the Errors of Physicians, that the Art of Physic should requite them in a beneficial Way for thus supporting the Dignity of the Profession."

Then as for the diseases resulting from occupational posture. Those who are obliged to stand for long intervals, especially if remaining immobile, as soldiers and butlers do, are liable to "Varices in the Legs" and "Ulcers," "nephritic Pains and a Pissing of Blood"—that is, stone in the kidney or bladder, I suppose. Those who have to sit at their work get round shoulders and a "Laxity of the Belly." Had he lived to-day he might also have mentioned the flat feet of waiters and policemen, and the pes cavus of mannequins.

Laundresses and washerwomen develop dropsy and also "Deficiency of the Menses," which is explained by the observation that "women under a menstrual Purgation are seized with a sudden Suppression upon walking only bare Foot, or washing their Legs and Feet with cold Water."

Midwives were liable to illnesses due to their contact with the lochia which precede and follow delivery, for these, in addition to conveying infections, were, like the menstrual flux, considered always to possess inherent "noxious Qualities." The menses were believed to have the property to make people mad. In the treatment of wounds, it was decreed that a wounded person must not so much as be looked upon by "women under their menstrual Flux or by men heated with venereal Embraces." These latter were also thought to be endowed with special potentialities, and Pliny said "that the Bees pursue Men who are just come from a venereal Encounter, as being mightily delighted with the Sweetness of Odours, and very observant of Chastity." From which it appears that bees disapprove of chastity. In Italy in the early eighteenth century, women at confinement were still delivered in a sitting posture, perched upon a perforated stool; an interesting

survival of a very ancient method. The midwife sat "bending forward with expanded Arms waiting the Egress of the Fœtus," and therefore was not only obliged to have the malignant lochia constantly falling upon her hands, but also became very greatly fatigued. Ramazzini, in order to minimize occupational disease amongst midwives, advocated the discarding of the stool, and averred that "the Midwives are not so exposed to Danger in England, France, Germany, and other Countries, where the big-bellied Women bring forth their Children in Bed."

The term, "nurse," was used not in the sense in which it is mostly now employed but with its essential meaning of the suckling mother. Errors in diet, irregular sleep, and a "Depredation of the nutritious Juice," caused diseases in their breasts, fevers, hysteric passions, consumptions, headaches, vertigos, and eruptions. They are advised as to a correct mode of living, and then, in making incidental reference to a "sympathy" which had been observed to exist between various organs of the body, these eighteenth century physicians foreshadowed our modern knowledge of endocrinology. The sympathy between the womb, the breast, and the thyroid was already well known. Speaking of the reaction of the womb during coitus it was said that this produced simultaneous and correlated reactions in other parts of the body. The ancients were aware of the concomitant enlargement of the neck, due to physiological swelling of the thyroid gland. On the wedding night they measured the bride's neck with a piece of thread; in the morning it was measured again, and if the thread was then found to be too short, there was appropriate jubilation for this was recognized as the clinical test "that the Bridegroom had made a Virgin a Woman."

Human occupations are too numerous to allow of them all being dealt with here, but I cannot omit to quote the advice of Plato about avoiding periphrasis and placebos in treating workmen. He says: "When a Tradesman is taken ill, he must be cured by Vomiting, or Purging, or Caustics, or Incision; for if a Physician tells him of a long protracted Regimen, and Bolstering up his Head, and the like, he presently replies, that he has not Leisure to be sick, and that it will be of no use to him to lead an idle lazy Life, and neglect his Business. Upon this he takes leave of the Physician, and returns to his usual Way of Living; and thus, if he recovers, he does his Business, or, if Nature gives Way to the Disease, is set free by Death."

Then for the ailments of learned men. Apologies are tendered for including them amongst tradesmen, notwithstanding the saying of Aristophanes that "if Poverty and Riches were out of the World, all things would be overturned, and Philosophy with all other Arts would lie uncultivated for want of Votaries." Advocates, barristers, judges, servants of great princes—which includes politicians I suppose—poets, philologers, divines, physicians, surgeons, and writers; these are the learned men. They suffer from the effects of their sedentary life. "A Man grows wise by sitting," and falls ill of dyspepsia, kidney troubles, arthritis, and shortsightedness. They are "thin, wan-coloured, morose, and Lovers of a solitary Life." They become melancholy and hypochondriacal. Many such men are to be seen every day, on the Bench, in the pulpit, at the Houses of Parliament, and at learned societies. Just as the watchful doctor may espy in the street a large "goitre" hurrying for a 'bus, differentiate an infantile paralysis from a tuberculous hip, or recognize even more intimate ailments, so too he can pick out men amongst the crowd who are suffering from learning. Pliny said: "*Atque etiam morbus est aliquis, per sapientiam mori.*" (It is a sort of disease to die of wisdom.) Great pains are taken to fathom and give a name to the illnesses of all patients, whereas not a few of them, when all is said and done, are only suffering from their occupations. It would be interesting to total up the number of illuminati who have been destined merely *per sapientiam mori*. And then, since in the matter of treatment one should follow the principle of prevention being better than cure,

you must wonder what attitude to adopt in the application of this principle to the disease of learning. Ramazzini offers a few crisp words of advice on hygiene, exercise, and diversion, and then, to be more express, he recommends good large periwigs for the learned to "guard their Head from the Injuries of the Air." He apparently disapproves of bald pates and long beards which have appeared at periods as the recurring vogue, from ancient right up to Edwardian times. As a combination they may create an aspect of erudition, but when considered separately they have less to recommend them. The former must be uncomfortably chillsome, while the latter can be most prolific media for zoological multiplication, and most unhygienic receptacles for debris. As for the afflictions of the surgeons and physicians, they are liable to the ailments of other learned men, and in addition incur special risks by their constant contact with disease. Their knowledge however teaches them a certain caution which often enables them to avoid infection. They also escape illness and melancholia due "to their great exercise, and to the Chearfulness of their Mind, when they return with full Pockets from visiting their Patients." How pleasant a prophylactic! How sanguine a prospect! Surgeons were liable to mercurial poisoning while anointing "pocky" patients, but only the "meaner sort" performed this treatment, "the better Sort of Surgeons decline such a sordid Piece of Service." It is recommended that the patient be instructed to rub the ointment in himself while the surgeon stands by. Finally, and pathetically, some doctors "have catched Ruptures by their constant Fatigue and climbing of Stairs."

The History of Bronchial Asthma and Allergy.

By E. Stolkind, M.D.

[*Abridged.*]

For a long time bronchial asthma was considered an idiosyncrasy or peculiarity of the human constitution and was familiar to the Greek, Roman and other ancient authors. It was a mystery and a scientific curiosity until the end of the last century. (Details concerning idiosyncrasies are to be found in an excellent little book by Sir Humphry Rolleston.) Reference to allergy was made by Jenner (1798), who noticed hypersensitiveness to variolous inoculations: "A woman had cowpox 31 years before. She was inoculated with variolous matter. An efflorescence of a palish-red colour soon appeared, spread extensively, but died away in a few days."

Magendie (1782-1855), a French physiologist, who discovered many new isolated facts, observed (1839) that a dog which tolerated quite well a first injection of albumin as also a second one of half this dose two days later, died immediately after the third injection of a half dose given the next day. From this experiment Magendie's only conclusion was that injection of albumin into the blood of animals may have fatal consequences. Later Landois and Hayem (1885-1890), Robert Koch (1890), Brieger, Behring, and Flexner (1894) noted that repeated injection of protein causes the hypersensitiveness of laboratory animals. In 1902 Portier and Richet studied the occurrence of this phenomenon more closely. Richet proposed calling it anaphylaxis as opposed to prophylaxis and immunity. Since then Arthus (1903), Pirquet and Schick (1903), Smith, Otto, Besredka and Steinhard (1907), Rosenau and Anderson (1907), Richet, and many others have contributed to the study of anaphylaxis. The terms anaphylaxis, immunity, and hypersensitiveness were not acceptable to all those working on this subject, and Pirquet (1906) proposed the term "allergy" (altered reactivity) ("from the word "allos," as in the word allorhythmy") instead. In allergic subjects the hypersensitiveness is mainly a question of qualitative reaction. It is most usual now among clinicians to follow Coca and apply the term "allergy" to diseases of hypersensitiveness in human beings, reserving the term "anaphylaxis" for experimental hypersensitiveness in animals.

The study of allergy and anaphylaxis is leading to an understanding of the pathogenesis of allergic diseases. Of these, the most troublesome and serious is bronchial asthma, and its history is of great interest.

Bronchial asthma is considered a syndrome by some and a disease by others, and is characterized by paroxysmal attacks of dyspnœa with wheezy respiration and generally prolonged expiration. After the attacks the lungs are usually in the same state as before. Asthma is of nervous origin, generally hereditary and due for the most part to the influence of the psychic factor, Pavlov's conditioned reflexes, and the parasympathetic system. Asthma is caused by allergens, and the hypersensitiveness in asthma, as in other allergic diseases, may be extrinsic (food, dust, cold . . .) or intrinsic (bacterial allergy, fatigue, emotion). The attack terrifies the patient. At the beginning of February of this year, a patient of mine, a nervous woman, who at one time had herself been a medical student, had her first severe (prolonged) attack of asthma. She had previously only had very slight attacks. She recovered immediately after an injection of adrenaline, but was so distressed that she committed suicide within a few hours, giving as her reason her fear of being an invalid. At the post-mortem (Dr. J. F. Taylor) nothing abnormal was found in the lungs.

According to Amman and Zacchia, as fear can provoke asthma, the asthmatics were absolved from criminal inquiry. Early Indian physicians knew of asthma and treated it by the smoking of datura.

The name asthma was used by the ancient doctors—Hippocrates, Galen, Aretaeus, Celsus, and others—to describe various forms of dyspnœa. Seneca, the Roman philosopher (A.D. 3—66) himself suffered from asthma and described his attacks. He apparently suffered from cardiac and not bronchial asthma. Aretaeus, a Greek physician, probably a contemporary of Galen, did not distinguish between bronchial asthma and other diseases causing paroxysmal dyspnœa. Aurelianus, Caelius gives a better description of bronchial asthma as a distinct disease. He was a celebrated Roman physician, a native of Sicca Veneria in Numidia, who lived in the fourth or fifth century. He was a follower of the great physician Soranus, and it is believed that he translated some of Soranus's books into Latin. In these books Aurelianus, speaking of pleurisy, states that by listening to the affected part of the chest a hissing noise can be heard. From this it is evident that he used auscultation of the chest. In his work *De morbis acutis et chronicis* he says that :—

"Asthma occurs oftener in men than in women, in middle age than in children or old men, and in the delicate rather than in the strong. More in winter than in summer and more at night than by day. In some it begins after disease, whereas in others it begins without obvious cause. . . . The patient has a feeling of suffocation, heaviness and burning heat in the chest, and a feeling of spasm in the bowels. It begins with violent suffering, wheezing and hissing in the chest, and the voice is weak, the neck and face stretched and red, the expression anxious . . . there are tears . . . and the pulse is weak. Asthma is distinct from other diseases, where there is difficult breathing, as well as from pneumonia, orthopnœa . . . etc."

Aurelianus suggests treatment by a simple clyster, poultices, laxatives, cupping of the chest with scarifications as well as steam, fomentation, sponging, rubbing of the arms, and during the paroxysm, if strength permits, venesection. In the interval between the paroxysms he advises walking, vocal exercise, change of scene, sea air, light, warmth, heliotherapy, massage of the chest, maintenance of good spirits, medicinal baths, accustoming oneself to cold baths, and moderation in food. This account of Aurelianus's of bronchial asthma falls in line with those of modern conception in a greater degree than any of those of his predecessors, or of any who succeeded him, for several centuries. That "prince of physicians," Avicenna, does not say more about asthma than Galen and his other predecessors had

said. As causes he mentions changes in composition of the air, water and food. He mentions also the influence of nerves (medulla spinalis) and brain on respiration. The next account of asthma of any importance was compiled by Moses Maimonides (1135-1204), the Jewish philosopher, talmudist, and physician, who was physician to Sultan Al-Malik-Al-Afdal (Cairo), who suffered from melancholia, constipation and asthma. It was for the Sultan that he wrote the treatise on asthma. His medical works, especially those concerned with dietetics and hygiene, were widely known, being the best works of his own and the thirteenth century.

Maimonides described cases of asthma in which there were paroxysms of suffocation. He was against the application of strong remedies, such as bloodletting, drastic purgatives, and drastic fasting; it being his opinion that such methods should only be used, if advised by an absolutely perfect doctor, and not on the advice of an ordinary one, or even on the advice of many in consultation. Maimonides advises moderation in food, drink, habits, and sexual life, life in the suburbs rather than in the town, having regard to the importance of obtaining fresh air and sunlight, which destroys the miasms of the air. He realized that all treatment had to be individual, owing to idiosyncrasies, for, whereas one patient might be relieved by drinking cold water, another might die of it. This being also applicable to food, cold baths, etc.

There was no medical literature to speak of until the seventeenth century. Many papers on asthma were written in the seventeenth and eighteenth centuries; Joseph Frank gives the names and titles of more than one hundred and fifty papers, mostly dissertations, written by young men who had no clear ideas about this disease. Most prominent, however, of that time were the following:—

Van Helmont (1577-1644), an original thinker and a well-educated physician of Bruxelles, speaks about dry and moist asthma and differentiates between (1) asthma due to the womb which commands the whole woman, and (2) that common to both sexes. In his book, *Ortus Medicinae*, published after his death in 1667, he says that the lungs are contracted or drawn together, and reports several interesting cases of asthma. In one case a monk had attacks of asthma only when there was wind or dust, or when he had eaten fish fried in oil. In another, a clergyman suffered from asthmatic attacks almost all the summer but was free all the winter. Each attack was accompanied by urticaria. The patient's mother and sister also suffered from urticaria. He mentions a case where the psychic factor caused asthma. A "prudent" man was unjustly and publicly reproached by his superior and was afraid to answer a word. Soon afterwards he had an attack of asthma and died two years later from dropsy. Helmont observed women in whom sweet odours, or sorrow, caused difficulty in breathing, headaches and syncope. Hoffmann speaks of convulsive spasmodic asthma.

Theophilus Bonetus (1620-1689), of Geneva, a prolific writer, in his *Medicina Septentrionalis Collativa* (1685), collected from literature a number of cases of "antipathies or idiosyncrasies" to food (bread, fruits, strawberries, wine . . .). In his *Guide to the Practical Physician*, he says that a convulsive asthma is often caused, when morbific matter falling upon the pneumonic nerves sticks somewhere in their passages, especially about their plexus. He reports the following cases of bronchial asthma (other cases reported as bronchial asthma do not belong to this disease): "A goldsmith's child was ill of almost desperate asthma. When I was called I suspected that the malignity of a mercurial fume had produced this disease. In another case a ten-year-old boy was affected at first with eczema. During a cold season this disease disappeared, but the filthy matter was turned upon the lungs and caused a horrible asthma, which ceased immediately when the wind turned to the south. In another case a patient had attacks on entering a wine cellar where the must was fermenting."

Some remarks about the relation between asthma and the nerves and brain can be found in Galen, Avicenna, Ballonius, and Felix Platerus. Galen mentions that

in experiments on animals (monkeys) by transverse cutting of the medulla spinalis, the respiration and the voice are affected. Ballonius, speaking about a patient with renal calculus and dyspnœa, says that there is a "nervulus" (small nerve) from the sixth pair which penetrates the diaphragm and goes to the kidneys and this may also cause dyspnœa.

Felix Platerus (1536-1614), who was also one of the first to advocate the treatment of mental patients, instead of chaining them or sending them to prisons, said that an obstruction in the small pulmonary arteries is the cause of asthma. But he mentions also that the bigger nerves from the dorsal medulla, when disturbed by defluxions, occasion dyspnœa, e.g., in asthmatics. He observed the attack when nothing abnormal in the lungs could be found.

The modern teaching concerning asthma really commenced with Thomas Willis (1621-1675). His important contribution to the knowledge of asthma was his recognition of its nervous origin (1680). "Whatsoever," he says, "makes the blood to boil or raises it to an effervescence, as violent motion of the body, of mind, the drinking of wine, venery, excess of external cold or heat . . ., any great change of the air or of the year, slightest errors, a thousand other occasions, doth cause asthmatical assault to such as are predisposed."

"This kind of dyspnœa, merely convulsive, is excited by reason of the pneumonic nerves." "It is not to be doubted that the fits of asthma wholly depend on convulsive matter being fallen into the nerves, serving to the stretching forth of the lungs." This coincides with the modern ideas of the influence of the parasympathetic system on asthma. "Soon as the asthmatic attack is finished, no signs of abnormal disposition of the lungs can be found. Severe attacks of asthma may occur without any notable fault of the lungs." Dr. Needbam told him of a butcher who suffered for a long time from asthma and died during a fit. At the post-mortem the lungs and other visceral organs were found normal. Willis recognized the influence of food on asthma. He reports a case of a twelve-year-old girl who had attacks of asthma by "reason of errors in diet or the great mutations of the year or air." In another case a man suffered either with headaches accompanied by giddiness, or by attacks of asthma.

His advice as to the treatment included the use of opium, which according to him helps when other medicine is ineffective.

Floyer (1649-1734), himself a victim of asthma for more than thirty years, published a treatise on asthma in 1698. He thought asthma due to constriction of the bronchi and "bladders" of the lungs. He followed Willis and Van Helmont in his views. He stated that many find the smoky London air unbearable. He, like many ancient physicians, recognized the influence of heredity in asthma, and mentions a case where the patient, his brothers, sisters, and grandfather were victims of asthma, though his father and mother were both free from it. This patient had attacks after eating eggs, salad and potted meats. Floyer found that "diet may be agreeable or injurious to asthmatics."

William Cullen (1710-1790), best known as a teacher of medicine, was influenced by the work of Willis. According to him the cause of asthma is the spasmodic constriction of the muscular fibres of the bronchi. He recognizes that in addition to meteorological and atmospheric conditions, the nervous system has a great influence through the mind, or by particular odours, by irritation of smoke or dust. Thus, Cullen recognized the importance of the psychic factor as a cause of asthma. He recognized that different asthmatics have different idiosyncrasies. Heberden (1710-1801) mentions autopsy in the case of a "very asthmatic man, where the lungs appeared perfectly sound and so did the heart and diaphragm."

A. Haller, linguist, encyclopædist and poet (1754), recorded that the lung of an experimental animal became contracted when acid was introduced. When the pleura was perforated, the lungs immediately, by continuous entry of air, pressed together toward the vertebræ.

Goodwin (1788) made a small incision into the cavity of the thorax of three subjects who died from hanging and from several other subjects. The lungs collapsed. He introduced water through an opening in the trachea into the lungs of three cats, which immediately suffered from difficulty in breathing. He produced an artificial hydrothorax in dogs, and considerable difficulty in breathing followed.

Bree (1797) repeated the same experiments. He was himself a sufferer from the "tyranny of attacks of asthma." He says "that convulsive asthma is caused by irritation of some material in the lungs, also by irritation in some of the abdominal viscera but particularly in the stomach." He mentions "hair-powder, as well as love and grief as causes of asthma." Bree also adds that "habit and perceptions of the mind exciting, by medium of sensation, motions of the body when under the influence of habit may cause asthma." . . . "The emotions of mind may return . . . and cause asthma." This reminds one of the conceptions of the conditioned reflexes of Pavlov. Bree advised large doses of iron for asthma.

Until the beginning of the nineteenth century there was no scientific proof of the theory of Willis, Floyer, Cullen, and others that asthma was of nervous origin and that there was constriction of the muscular fibres of the bronchi. It was Reisseisen (1808) who proved that there were smooth muscle fibres in the terminal bronchi, that the "eighth"[1] pair of nerves ended in the bronchial blood-vessels, and that the "lung was a contractible bladder." He and Prochaska (Vienna) found, like Haller, that on opening the chest, the lung of a living animal contracted.

At the same time a new method of diagnosis of diseases of the chest was found; percussion by Auenbrugger (1722-1809) (Vienna) and immediate auscultation by Laennec (1761-1826). Laennec records several cases to show the influence of the nervous system and of the psychic factor on the attacks, such as that of an asthmatic who had attacks if anyone shut his bedroom door or if his night lamp had by any chance gone out.

To this period belong the experiments of Dupuytren, Dupuy, and Magendie, who showed that section or ligature of the "eighth"[1] pair of nerves always produced convulsion of the respiratory muscles.

Legallois (1812) showed that bilateral section of the vagus nerve may produce pneumonia. He, as did Bell, demonstrated that the medulla oblongata was the source of respiratory motions. Flourens (1824) discovered the bilateral centre of respiration in the medulla oblongata, lesion of which causes asphyxia.

Reid (1838) demonstrated that dyspnœa is sometimes present after section of the "eighth"[2] pair of nerves when the passage of air into the lungs is quite unobstructed. Williams showed that an electric current passing through the lungs induced their contraction and was of opinion that the contraction might become habitual.

Longet (1842), by his interesting experiments on horses and oxen, demonstrated that contractions of the bronchi occurred when a galvanic current was applied to the branches of the vagus nerve in the larger bronchi. Marshall Hall (1833) subscribed to the opinion of Legallois and Flourens as regards the motive of respiration proceeding from the medulla oblongata, and discovered the reflex source of muscular action. He considered that asthma consisted in an action excited by the pneumogastric and spinal nerves which convey the impression, probably reflected upon the muscular fibres of the bronchi, which contract.

See (1865) wrote that asthma is a pneumobulbar neurosis due to the excitable and exaggerated or perverted reflexes from the respiratory centres of the medulla oblongata. Without this hyper-excitable medulla oblongata asthma did not appear. On occasions asthma was produced directly by the excited vital node

[1] 10th.

[2] In the eighteenth and beginning of the nineteenth centuries nervus vagus (the tenth pair) was called plexus bronchialis . . . or nervus vagus or eighth pair.

or reflexly by the respiratory centre, but generally by centripetal stimulation of the vagus nerve. Later Einthoven (1892), Brodie and Dixon (1902), through their experiments, came to the conclusion that carbonic acid, in excess in the blood, caused considerable activity of the centre in the medulla oblongata. Dixon (1909) expressed his opinion that there must be a neurotic type of medulla as a predisposing cause of asthma. In the same year (1909) the theory of vagotonia was brought forward by Eppinger and Hess to explain bronchial asthma.

Elliotson (1786-1868), who first introduced hypnotism into England, was also the first to ascertain that hay fever was caused by pollen. In some persons asthma is only induced by certain exhalations from the vegetable kingdom or by certain foods. He mentions a case of asthma caused by emanation from a guinea-pig and another of hay-fever due to contact with a hare.

Trousseau (1801-1867) himself had been long subject to asthma, and his fits used to occur at about 3 a.m. He thought that asthma was the result of spasmodic constriction of the bronchi, and that migraine, eczema, gout, rheumatism, hæmorrhoids, and gravel were complaints which might be replaced by asthma. Trousseau describes his own case, in which the smell of violets or the dust of oats produced attacks as well as cases due to the dust of flax, feather beds, or ipecacuanha.

Courty (1859) described a case of a woman suffering from severe and prolonged attacks of asthma, and whom he treated by the same method with which he treated neuralgia, i.e., by injection of atropine near the vagus nerve.

In Germany Wintrich and then Bamberger were of the opinion that asthma was caused by a tonic spasm of the diaphragm alone, or by a combined spasm of the diaphragm and respiratory muscles.

Bergson, in a very good monograph (1850), Merkel, and Weber were of the opinion that asthma was a vasomotor neurosis; Albert Fraenkel considered it a reflex neurosis. Leyden found Charcot's crystals in the sputum of asthmatics, and thought that they caused asthma by irritation of the mucous membrane of the alveoli and smaller bronchi and the endings of the vagus nerve. Curschmann found spirals which are now called by his name, and which, he thought, participated in provoking attacks.

The best nineteenth century work on asthma is that of Salter, who was himself a victim of asthma from childhood and of hay-fever in his later years. In Salter's book we find many modern views on asthma. Salter saw in asthma "a peculiar morbid irritability of the nervous system, especially of the pneumogastric nerves, and the nerves that supply the respiratory muscles, either at the peripheral extremities, or at their central termination in the medulla oblongata and spinal cord. . . ." "In large numbers of cases the pneumogastric nerve is the seat of the disease. . . ."

He called special attention to asthma from toxæmia, from animal emanations (cats, rabbits, horses, dogs, cattle, wild beasts, etc.).

Salter was convinced that asthma was hereditary, and more than thirty years ago I published cases of asthma in nervous children, supporting this view. Of his 217 cases he found distinct traces of heredity in 84. Salter, like many authors before him, mentions venereal excitement as inciting severe attacks. On the other hand, in three further cases he observed that venereal excitement would almost invariably cure the most severe asthmatic attack. This is of a certain amount of interest just at the present time, when quite a number of asthmatics are being treated by psychotherapy.

Voltolini in 1871 reported a case of asthma which he cured by the removal of nasal polypi. He, and later B. Fraenkel, were of opinion that polypi indirectly produce asthma. Since then the rhinologists claim that there are hyperæsthetic nasal areas in asthmatics and in patients with hay-fever, and perform various operations on the nose, mostly without result.

The latest theory is that asthma is an anaphylactic or allergic disease, due to hypersensitiveness to food, heat, cold, light, inhalants and other allergens. This theory is now supported by the majority of physicians. Wolff-Eisner (1906) reported that of his ninety cases of asthma, all, except four, reacted with signs of hay-fever to pollen (in salt solution) placed in the eye. He compared hay-fever with anaphylaxis caused by foreign proteins. Langlois, in the same year, very briefly mentioned that hay-fever is an example of anaphylaxis. Auer and Lewis, and later, Anderson and Rosenau, Anderson and Schultz, Biedl and Kraus reported that the breathing in animals in cases of anaphylactic shock reminded one of asthmatics. The cause of the acute anaphylactic death in guinea-pigs was a constriction of the bronchi, due to a tonic contraction of their muscle fibres. On account of these findings Meltzer concluded (1910) that asthma was an anaphylactic phenomenon; asthmatics were individuals who were sensitized to a specific substance, and an attack of asthma set in whenever they were intoxicated by that substance. Beal (1910) wrote a thesis entitled *Anaphylaxie dans l'asthme* (Paris).

The present time might be called the period of testing, especially by cutaneous methods. Jenner (1798) was the first to teach that it is possible to determine whether an individual is susceptible or immune to small-pox by tests. Later, testing was applied in cases of hay-fever (Blackley), of tuberculosis (Pirquet), then of diphtheria (Schick) . . . and in food and inhalant hypersensitiveness by Schloss (1912), Noon, Freeman, Walker, Cooke and others. Since this has been done the allergic theory has been supported by the majority of physicians.

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Section of Anæsthetics.

President—C. F. HADFIELD, M.D.

[*May 5*, 1933.]

Bronchoscopy in the Diagnosis and Treatment of Post-Operative Lung Complications.

By V. E. NEGUS, M.S., F.R.C.S.

ABSTRACT.—Lung complications calling for bronchoscopy are not frequent, because suitable precautions are taken by most anæsthetists and surgeons. A certain number of cases occur, however, sometimes diagnosed as pneumonia, but actually due to mechanical obstruction of a bronchus.

Suspected cases require bronchoscopy for diagnosis and respond well to treatment by aspiration and direct medication.

All cases due to foreign body can be cured, and most post-operative lung abscesses clear up quickly. Diffuse bronchitis is improved and its cessation prevents the subsequent development of multiple bronchiectasis. Acute massive collapse is in very many instances the result of occlusion of a bronchus by a plug of thick mucus, removal of which effects a cure.

ALL surgeons and anæsthetists are interested in post-operative lung complications, and are concerned as to their avoidance; particularly is this true of those who have to deal with operations in the upper air passages.

The nose and throat surgeon is called upon to diagnose and treat cases of lung suppuration with the bronchoscope; he has opportunities of studying the normal mechanism of the tracheo-bronchial tree by direct observation, and of examining cases in which pathological changes have taken place.

I myself have had the opportunity of dealing with a certain number of cases, but very many of the observations I have to offer are gathered from sources other than my own, and particularly from the teaching of Chevalier Jackson, who has thrown light on the causation of suppurative diseases of the bronchi and lungs, and from his wide experience has drawn invaluable conclusions as to their treatment and prevention.

The conditions directly concerning the anæsthetist and bronchoscopist may be classified thus:—

(1) Inspiration of foreign body. (2) Diffuse suppurative bronchitis. (3) Lung abscess and bronchiectatic abscess. (4) Acute massive collapse or atelectasis. (5) Multiple bronchiectasis.

NATURAL DEFENCES OF THE LUNGS.

Before considering the causation and treatment of these various conditions, it is expedient to review briefly the factors concerned in protecting the lungs against infection or the entrance of foreign bodies.

Every minute of our lives bacteria are entering the lungs without causing pathological changes [16, 17]; the numbers of bacteria are increased enormously in patients with dental, nasal, or pharyngeal sepsis. Very frequently foreign bodies are in situations without danger during normal conditions, although during anæsthesia similar circumstances might lead to an accident.

(*a*) *Protective closure of the larynx* does not offer any real safeguard against bacterial infection; its useful rôle is concerned with the exclusion of foreign bodies. Protective

closure is carried out by the aryepiglottic folds, which are drawn together and at the same time forwards against the cushion of the epiglottis. The larynx closes either voluntarily, if warning is given or involuntarily, if an intruding substance touches the mucous membrane of the lower pharynx or the margins of the laryngeal aperture.

Voluntary closure cannot be maintained for long because rising carbon dioxide concentration stimulates the respiratory centre and causes the larynx to open. In such an operation as dental extraction the patient may be forced to take an inspiration at the precise moment when a tooth drops down, with the unfortunate result that the foreign body is carried by the inspiratory air stream into the lungs.

During the induction of anæsthesia voluntary control is obliterated and a deep inspiratory effort may suck in packing placed in the nose, if it be not securely fastened.

The ease with which liquids will enter the larynx is seen in Singer's drop-method of introducing lipiodol into the lungs. If the oil be poured drop by drop on to the base of the protruded tongue of a perfectly conscious individual it will enter the trachea. Mullin [28] found that indian ink placed in the nose of a rabbit enters the lungs readily.

During anæsthesia liquids enter even more readily, as illustrated by the observations of Myerson [29] who passed a bronchoscope on patients after tonsillectomy. Blood was found in the trachea and bronchi in a large proportion of cases, namely in 76 out of 100 cases. Hara [11] examined 110 patients after tonsillectomy and found blood in very many, in greatest quantity after operation in the sitting position. Similar conclusions were drawn by Benjamins [1] who placed lipiodol on the tonsils before operation and saw it in the lungs by X-rays,

If the larynx is made insensitive with cocaine, blood, pus or foreign bodies will enter more readily still, either during local or general anæsthesia. It is not even necessary to spray, drop, or paint cocaine solution on to the larynx. If any trickles down or is purposely applied to the hypopharynx it will cause block anæsthesia of the superior laryngeal nerves [27], which supply the upper part of the larynx; they lie close beneath the mucous membrane in the anterior part of the pyriform fossa.

Even in such operations as removal of tonsils under local anæsthesia there may be a loss of sensation, due to descent of cocaine. Anæsthetization of the larynx does not affect the cough reflex in the bronchi, however [18].

The protection of the larynx is diminished or abolished by mechanical interference, noticeably by the use of the Davis gag, which lifts the tongue and epiglottis and may, in certain cases, prevent the aryepiglottic folds from reaching the base of the epiglottis. Prevention of accumulation of blood by suction is the means of avoidance of danger under such circumstances.

(*b*) *Cough* is, of course, a most important method of defence if foreign bodies try to pass, or have passed, the larynx.

Sensory stimulation of the laryngeal, tracheal, or bronchial mucous membrane causes closure of the larynx, accompanied by a forced expiratory effort. The ventricular bands, as well as the vocal cords, are closed, and a high pressure is reached. The larynx is then opened suddenly, and the escaping blast of air may remove the foreign body or infected secretions if they are not jammed in the bronchi. If a catheter is in position between the vocal cords the mechanism is inefficient, because the larynx cannot close completely. In a few minutes the sensitiveness of the mucous membrane disappears and no further effort is made to expel the intruding object or the exudate [18]. A solid body or a clot may lie in a bronchus for an indefinite period without inciting any cough after the first paroxysm has passed.

It is obviously fallacious therefore to rely on the cough reflex for protection of the lungs, because of its brief duration.

A second factor in cough must be considered. This is in connection with the inspiratory opening and expiratory contraction of the bronchi which occur during

normal respiration (Fig. 1, A and B) [40, 6, 15] ; both opening and closure are much more marked during cough, as may be seen clearly during bronchoscopy [21].

Closure appears to be due to active contraction of bronchial and bronchiolar muscles ; inspiratory dilatation is caused by elastic recoil of the bronchi and the pull of the expanding lung, which itself depends on the negative pressure in the pleural cavities. Expiratory contraction squeezes secretions out of the bronchi, possibly in a peristaltic manner.

Any object entering the larynx during inspiration is sucked through the trachea into one or other widely open bronchus, and travels as far as the calibre allows. At expiration the bronchial walls contract on it and hold it firmly ; the more violent the cough, the more firmly is it held, particularly if it be of a shape to fit the bronchus, as, for instance, a tooth or a clot of blood or semi-solid secretion.

The distance to which an object travels down the tracheo-bronchial tree depends to a great extent on the depth of inspiration ; the forced inspiration of the semi-

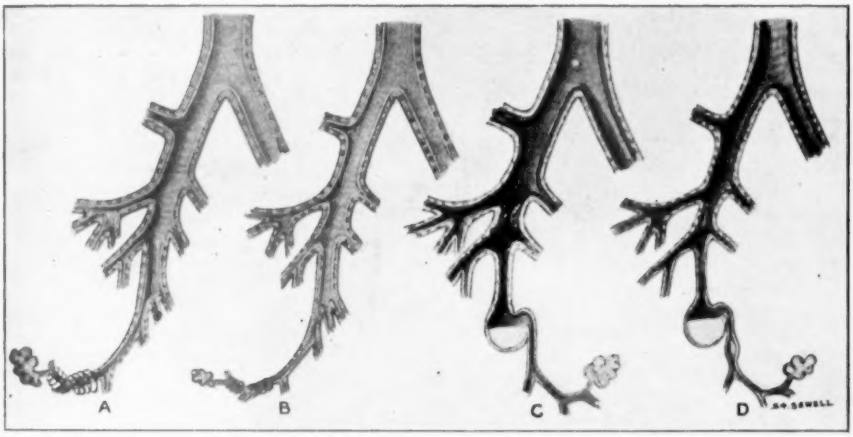

FIG. 1.—Diagram to illustrate the normal inspiratory dilatation of the bronchi (A) and their expiratory contraction (B). Pathological changes are seen in (C), in which granulation tissue and inflammatory swelling have narrowed the bronchi leading from an abscess cavity. The bronchi are dilated during inspiration in (C), but close completely during expiration or cough (D).

conscious patient is liable to carry the intruding substance to a depth from which it cannot be removed by subsequent cough. In addition to changes in size during each respiratory cycle, the bronchi also show slow peristaltic waves travelling upwards, independent of cough, and of larger cycle than the respiratory movements. They have been described by Bullowa and Gottlieb [5]. These movements help to empty the lungs of secretion ; they are much faster than ciliary action.

(*c*) *Secretion of mucus* is of great importance in preventing infection of the lungs. It is not necessarily bactericidal but is strongly inhibitory to the growth of organisms [9]. One requisite for its efficient action would appear to be constant replacement ; this necessitates satisfactory aeration of all parts of the lungs.

If a bronchus is obstructed, partially or completely, the mucus in the distal region is not removed and stagnation results. The stagnant mucus has only a certain degree of inhibitory power and after this is exhausted bacteria will be able to grow and multiply.

It is obviously important that the supply of mucus should not be dried up too completely, as, for example, by excessive doses of atropine. If such an occurrence takes place there is nothing to inhibit the growth of bacteria, nor is there a supply of fluid to bathe the cilia, which cannot work if dry.

(*d*) *Ciliary action* is the last factor to be considered in studying the mechanism of protection of the lungs. It is specially valuable in removing bacteria before they obtain a foothold; it is not sufficiently strong to remove a solid object, except one of minute size. The cilia all wave in one direction and a stream of mucus is carried along in the direction of their recoil [34]. They have no effect on secretion at a distance from them; if a bronchus becomes filled with secretion ciliary action will not remove it, because of back currents [32, 33].

Cough can, of course, remove masses of secretion and small solid objects, but it is not the normal method of clearing away bacteria carried into the finer air passages by the inspiratory current. Cough is not a frequent occurrence, except in diseased states and is of no help to the normal individual, who may never cough at all, even though many bacteria are entering his lungs every minute.

It is on ciliary action that elimination of germs depends; it is most important in emptying the periphery of the lungs [23]. Efficiency of the action is influenced by several factors.

Cilia must be bathed in mucus and this mucus must be of a faintly alkaline reaction; many observers have noted that weak acids paralyse cilia [2]. Leonard Hill [14] has measured the rapidity of action accurately. I have seen immediate paralysis with a solution of acetic acid 1 : 20,000. Carbon dioxide is strongly inhibitory because it makes the secretions acid; the action is, however, no more than temporary.

Alterations in the pH of the tissue fluids appear to affect the action and therefore acidosis is to be avoided. Prolonged administration of both ether and chloroform reduce the alkali reserve of the blood [13].

The end-products of some pathogenic organisms have an acid reaction, as noted in suppuration of the nasal sinuses by Mittamaier [26], and therefore a vicious circle is brought about by bacterial activity in the bronchi, as, for instance, after breaking down of an inspired and infected clot. The products of growth paralyse the chief means of removal of the cause of disease. Ether vapour is temporarily inhibitory and chloroform much more powerfully so. Coal gas stops cilia [14].

Proetz has, however, seen active ciliary movement on pieces of mucous membrane removed from the nose of patients suffering from suppurative rhinitis [33].

Another factor in considering ciliary action is the necessity of preserving interrupted continuity of ciliated epithelium. All cilia in the bronchi and trachea work towards the larynx, usually against the force of gravity, but if the chain is broken at any one spot removal of secretions and bacteria by cilia is impossible. Such interruption is caused if liquid chloroform or ether lie on the mucous membrane, as observed by Professor Hill [14].

If ether is warmed so much that it boils it will give off vapour which may recondense in the delivery tube and even reach the trachea or bronchi in liquid form. The habit of attempting to produce rapid volatilization may thus have dangers; the warming of the ether-laden air in a coiled tube in passing through warm water has not this disadvantage.

Transformation of ciliated into transitional or squamous epithelium has a similar result and so too has the formation of granulation tissue, which is never covered with ciliated epithelium.

In a bronchiectatic abscess—a condition particularly liable, according to Lilienthal [25], to follow the operation of tonsillectomy under general anæsthesia—the lining membrane is covered with stratified squamous epithelium and not by columnar ciliated type. Ciliary action is not available therefore to empty the cavity.

THE RESULTS OF INEFFICIENT DEFENCE OF THE LUNGS.

(1) *Inspiration of a foreign body* may occur during general or local anæsthesia. The objects likely to enter the lungs are teeth, pieces of swab or sponge [38], a part of a tonsil, adenoids, or a nasal plug.

During dental extraction of teeth with local anæsthesia it has happened many times that a tooth has slipped from the grasp of the forceps or that the crown has broken off and fallen down the pharynx, while the patient gasped—not unnaturally—when taken unawares. The tooth descends the bronchial tree as far as its size will allow.

With general anæsthesia the danger of entrance of a foreign body is greater if the operation is performed in the sitting position; this applies particularly to dental extraction and to tonsillectomy.

The administration of gas eliminates the voluntary effort of the patient to close the larynx, while still allowing deep inspirations to be taken. It is not surprising therefore that teeth are inspired. Safety is attained by protecting the pharynx with a sponge, or by performing the operation in the lying position with the use of a head-light.

During tonsillectomy the greatest danger of inspiration of foreign bodies occurs when the patient is sitting up, for a dislodged tooth or a piece of sponge easily follows the air stream down the trachea.

Bronchoscopy is of course the only method of removal of foreign bodies. Every object which passes down through the glottis can be removed by the same route, as taught by Chevalier Jackson.

Diagnosis is made on the history of the accident or on symptoms of cough followed by expectoration, and on the physical and radiographical signs, none of which need be considered here.

If suspicion of a foreign body is aroused, it is best to disprove or confirm the diagnosis by the use of the bronchoscope, with local or general anæsthesia.

I have at 6 o'clock removed a tooth which was lost in the patient's mouth at 4.15; it showed up in a skiagram—unlike some others which are not easily seen.

It is well to realize that the entrance of a foreign body is an easy occurrence; much valuable time would be saved if bronchoscopy were resorted to early, instead of waiting for the inevitable lung abscess to form.

(2) *Diffuse suppurative bronchitis* may arise after general anæsthesia; it is characterized by the expectoration of copious purulent sputum. The accidental entrance of liquid ether or chloroform will cause it: if such an accident occurs it is quite possible that bronchoscopic lavage, performed early, would save the patient from death. A suction pump may be connected to an endotracheal catheter in such cases if a bronchoscope is not available.

Complete paralysis of ciliary action is an important factor in this condition, the anæsthetic remaining in the tracheo-bronchial tree, and there causing acute inflammation. A vegetable foreign body inhaled into the trachea or bronchi produces similar symptoms; the entrance of such an object is not, however, likely to be associated with anæsthesia. More common causes are the entrance of infected blood, of pus or of vomit. Infection is very liable to occur if dental sepsis is present.

Bronchoscopy is of great value in cases of severe post-operative suppuration. Removal of the pus by aspiration may prevent the patient from drowning in his own secretions, as described by Chevalier Jackson. If a tracheal cannula is in position a rubber catheter may be passed through it, and secretions aspirated by means of an electric suction pump kept at the patient's bedside. Ciliary action is insufficient to remove copious secretions; it may even be paralysed by the reaction of the sputum. Cough does no more, in many instances, than propel the

sputum halfway up the trachea, whence it gravitates once more into the bronchi. This is well seen with a bronchoscope, for even though a patient has coughed violently before the introduction of the tube, his bronchi may be found almost full of pus.

The bronchoscope also allows one to see that when the bronchial walls are inflamed they come together completely during cough, instead of merely causing diminution of the bronchial lumen. The result is that any pus in the alveoli or finer air tubes beyond the inflamed bronchi cannot escape (Fig. 1, p. 35, C and D). It is necessary to insert an aspirating bronchoscope to hold open the inflamed walls, when cough will be able to expel secretions from the distal area, or else to remove the pus directly by means of a fine flexible suction tube.

(3) *Lung abscess and bronchiectatic abscess.*—The most frequent cause of these conditions is the inspiration of infected blood-clot or an infected foreign body, such as a tooth or a swab, or vomited material, during operations on the mouth or pharynx, and in particular during dental extraction and tonsillectomy. Pulmonary abscess is said to occur once in from 2,500 to 3,000 tonsillectomies [27]. Entrance of blood or pus alone may cause bronchitis, but a lung abscess is not likely to appear unless a bronchus becomes partially or completely blocked. A clot from the mouth or pharynx may pass the larynx—particularly if the hypo-pharynx has been anæsthetized, as may occur during tonsillectomy with local anæsthesia—because the latter is held open by a Davis gag, or because deep inspirations are taken during the operation, or because the operation is performed in the sitting position. The clot descends with bacteria caught up in it; it is sucked down as far as its size permits, and cannot be expelled by cough, because of expiratory contraction of the bronchi. No inhibitory mucus can reach the entangled bacteria, and ciliary action is not sufficiently powerful to dislodge the mass.

The bacteria grow and multiply and cause inflammatory swelling of the bronchial walls, often with the shedding of epithelium, and later with formation of granulations. Because of the obstruction, mucus cannot escape from distal bronchi, and it is therefore not replenished; bacteria grow and cause infection of a lobe. Air cannot enter, and that which is present is absorbed, with collapse of the alveoli.

When the clot disintegrates there may be so much swelling of the bronchial walls that entrance of air and escape of secretions are still prevented. Ciliary action is ineffective because of mechanical obstruction to the passage of secretions, or because of the formation of granulations, or the paralysing action of pus. Cough may raise the pressure of retained air or of secretions beyond the obstruction, and may thus blow out the weakened bronchial walls just distal to the point of blockage, with formation of bronchiectasis. Cavities in the lungs due to local suppuration may be of three classes: an abscess in the parenchyma of the lungs, draining into a bronchus: a localized dilatation of a bronchus, namely, a bronchiectasis; or a combination of the two, or bronchiectatic abscess.

The patient develops symptoms suggestive of lung abscess on about the seventh or tenth day: the diagnosis is confirmed by the physical and X-ray examination.

Bronchoscopy should not be held in reserve; its early use may be the means of avoiding a long illness or of saving the patient's life. If a patient coughs up large quantities of pus during a short period of time, that is sufficient evidence that he has a reservoir of infected secretions; as with an abscess in any other part of the body, the most important point is to establish drainage. This is done by bronchoscopy with local anæsthesia. An aspirating bronchoscope is passed and the diagnosis is confirmed, if necessary, by locating the escape of pus from one lobe. Swelling of bronchial walls and the formation of granulations are visible. If no pus escapes a flexible suction tube is passed into the bronchus leading to the suspected lobe and immediately, or subsequently, pus may be expelled from an unplugged tube.

When the site of the abscess is located, aspiration is used to remove infected clot, and a flexible tube is passed to reopen stenosed bronchi; granulations are painted with 10% solution of silver nitrate.

The procedure may need repetition on one or more subsequent occasions, but in practically every case of post-operative lung abscess dealt with by bronchoscopy within a period extending to as much as two months, cure should be obtained. (Figs. 2, 3, 4). Chevalier Jackson [19] reported cure in 61% in a series of 224 cases following tonsillectomy.

If a foreign body is discovered and removed, rapid cure is certain to follow.

It has been thought that many lung abscesses are embolic in origin because they occur in the upper lobe of the right or left lung [30]. I do not consider this to be a valid argument.

FIG. 2.—Mrs. C., 25.11.27. Abscess cavity in right upper lobe following tooth extraction Before first bronchoscopy.

If a patient is lying flat or is sitting up, a clot, like any other foreign body, may travel straight down into a lower lobe, more often on the right side, because that bronchus is more in line with the trachea than is the left branch. If, however, the patient has returned to bed, and is lying on his side, when a clot is carried in by a powerful inspiratory effort, it is probable that the object will fall into the open mouth of the upper lobe bronchus, over which it must pass; the force of gravity determines its direction to a certain extent. The inspiratory current of air may, of course, carry a light object, such as a clot, into an upper lobe bronchus with great ease. Some observers report that post-operative lung abscesses occur more often in the upper than in the lower lobes [10].

There is no doubt that some abscesses form in the lung parenchyma, and later burst into a bronchus, but it is probable that the number is few; of those thought to arise in this way, because of no obvious communication with the

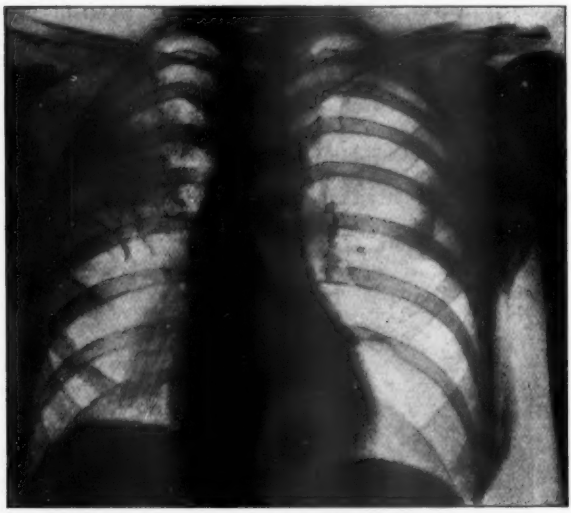

FIG. 3.—Mrs. C., 2.12.27. After first bronchoscopy. Abscess clearing up.

FIG. 4.—Mrs. C., 9.12.27. Lung practically clear after second bronchoscopy.

bronchus when they are first diagnosed, a certain number, no doubt, commence in a small bronchus, which becomes blocked by the infected clot which causes them.

(4) *Acute massive collapse of a lobe* sometimes calls for bronchoscopic diagnosis and treatment. The observations of bronchoscopists, and particularly those of Chevalier Jackson and Gabriel Tucker [39], show that in many cases the condition is caused by plugging of a bronchus with viscid mucus [12]. Aeration of the lung beyond the obstruction is impossible, and the air in the shut-off lobe is absorbed, causing atelectasis [8]. For the reasons already given, lack of fresh supplies of mucus and absence of ciliary action allow bacteria to grow and multiply. Inflammatory reaction causes still greater obstruction, and catarrhal or purulent exudation. The affected lung area is thus drowned in secretions.

Briscoe has shown that deflation is a common post-operative occurrence [4]. Absence of air and of respiratory movements in a lower lobe favour stagnation of mucus.

The patient suffers from fever and cough and appears to be very ill. There is deficient or absent air entry in the shut-off area, and upward displacement of that side of the diaphragm [7, 3]. The heart is displaced towards the affected side [22].

Massive collapse may occur after any operation, but particularly after those on the upper abdomen; deficient movement of the diaphragm, as originally described by Pasteur [31], is no doubt a powerful factor, associated with deflation [4]. Inspiratory dilatation of bronchi and bronchioles is diminished and secretions are not removed.

If suspicion arises that a bronchus is blocked, bronchoscopic examination is called for if medical treatment, with correction of inefficient breathing, does not cure the condition rapidly by producing re-expansion of the lung.

The instrument is passed, preferably with local anæsthesia, and may reveal redness and swelling of a lower lobe branch, possibly with complete occlusion: probably little pus will be seen, because of bronchial obstruction. Passage of a fine flexible-ended suction tube down the suspected bronchus may release purulent secretion, either immediately or after aspiration.

The patient will cough up much purulent sputum and his symptoms may improve rapidly, even after one bronchoscopic treatment.

(5) *Multiple bronchiectasis* sometimes dates from the time of an operation. The history, however, is often so long that it is difficult to say whether the cause was in the operation itself, or in the disease it was intended to relieve. For instance, many cases follow suppurative sinusitis, the lung symptoms and signs commencing after the operation. It is probable, however, that infection from the patient's own pus is the cause. This supposition is supported by the fact that many cases commence in childhood before any operation has been performed.

Diagnostic bronchoscopy reveals escape of pus from one or more branch bronchi, often with redness of the walls and the formation of granulations.

Aspiration of pus, destruction of granulations by swabbing with 10% solution of silver nitrate and dilatation of stenosed bronchi may give considerable relief. The condition is, however, difficult to treat, and in most cases nothing more than alleviation of symptoms can be obtained.

Avoidance of Lung Complications.

Although really beyond the scope of the title, it may add completeness to the paper and relieve the bronchoscopist of work if consideration is given to means of avoidance of the various post-operative complications.

(1) *Prevention of inhalation of a foreign body* is difficult if operations are performed in the sitting position. Protecting the larynx by means of a sponge in

the pharynx during tooth extraction is a necessary precaution. In tonsillectomy cocainization of the larynx should be avoided by seeing that no cocaine trickles down to the hypopharynx. With general anæsthesia for operations in the mouth or throat, safety is assured by the use of the Rose or Trendelenburg position and by the prevention of deep inspirations. Loose objects will tend to drop into the pharynx or nasopharynx and not into the larynx, if the head be lower than the body.

Nasal packing must be anchored outside the nose, the gauze in the nasal fossæ being tied together; there should be a single piece only of plugging in each side of the nose. Plugs—particularly these made from glove fingers—put in after such operations as submucous resection must be tethered with threads and strapping.

(2) *Diffuse suppurative bronchitis* caused by entrance of blood or pus is not likely to happen in nasal operations with local anæsthesia, because secretions are swallowed and not inhaled. In tonsillectomy in the sitting position care must be taken to avoid anæsthetization of the larynx.

Dental sepsis must be attended to before operation in all cases. When general anæsthesia is employed the dangers are considerable. During dental extractions the pharynx must be protected by gauze or sponge.

In operating on the nose and sinuses, safety is attained by the use of endotracheal anæsthesia with return airway, the pharynx being packed with gauze as advocated by Magill. It would appear unwise to introduce a catheter through the nose into the larynx if nasal sepsis is present.

In operating on the mouth or pharynx in adults, endotracheal anæsthesia is a safeguard. The respirations should be kept so shallow that no secretion is sucked in through the larynx. The patient should be in the Rose or Trendelenburg position. Suction is essential, preferably by means of a gum-elastic catheter passed through the nostril into the nasopharynx; the latter acts as a sump. It is, in my opinion, inadvisable to anæsthetize the laryngeal aperture, because of the danger of inefficient closure when the patient returns to bed. He should have the foot of the bed raised and should lie on his side, particularly if paraldehyde or avertin have been given beforehand: little danger should arise if these precautions are taken.

In laryngeal operations tracheotomy is of great use, a window being made and a pack of gauze being inserted through it from below upwards towards the larynx. An excellent form of anæsthesia in my experience is rectal oil-ether followed by a little chloroform.

After operation, rapid recovery of the patient from the anæsthetic is desirable and the sitting position is used, so that free breathing and effective cough may expel secretions.

Over-use of drugs likely to diminish cough, such as morphia, is to be avoided. Morphia is said also to slow ciliary action [14].

Condensation of ether in the bronchi is naturally to be avoided. Such an accident appears to be a real possibility; it will not occur unless the ether bottle is overheated. Carbon dioxide, given at the end of the anæsthetic, readjusts the composition of the alveolar air and of the blood and tissue fluids [12A]. Any inhibitory effect of this gas on ciliary action passes off quickly [14].

As regards the use of atropine, it would appear that if so much were given that the bronchial mucous membrane became quite dry, there would be paralysis of ciliary action and loss of the inhibitory power of mucus, with the probability of growth of bacteria. Such an occurrence is not likely, because of the irritative effect of anæsthetic vapours. Even with the largest doses of atropine in use, there is generally an excess of secretion.

(3) *Prevention of lung abscess and bronchiectatic abscess* follows the same lines as those just enumerated. In addition it is important to prevent the formation of

clots ; this is effected by seeing that blood does not accumulate in the nose, nasopharynx and pharynx during operation and that it is all removed before the return of the patient to bed.

It is quite possible, if this precaution is not taken, to find inspiration of clots. The field of operation may have appeared quite dry, but blood may have been left behind, particularly in the nasopharynx, in which it is hidden, to descend when the patient changes position on return to bed.

If clots are present in the mouth, nasopharynx, or pharynx at the end of operation the use of carbon dioxide may be dangerous because the forced inspirations may suck them into the trachea or bronchi.

(4) Free aeration of the lungs is necessary to prevent solidification of mucus in a bronchus causing *massive collapse*. The use of carbon dioxide at the end of operation appears to meet this end, with the precaution mentioned above ; temporary paralysis of cilia may be produced but this soon passes off when oxygen or fresh air reaches the bronchi.

Paralysis of cilia after descent of liquid chloroform or ether is not likely to occur, except under most unusual circumstances.

After operation the patient should, if possible, be placed in such a position that the bases of both lungs can expand ; a permanent position on one side may lead to trouble. After laryngeal operations blockage of a bronchus is prevented by the use of suction through the tracheotomy cannula.

(5) The avoidance of *bronchiectasis* is attained by taking the precautions suggested under the heading of suppurative bronchitis. Multiple dilatation of bronchi may follow long-standing inflammation of the bronchi, with blowing out of the weakened walls during cough.

If measures are taken to prevent infection of the lungs at the time of operation, bronchiectasis will not be a complication of anæsthesia.

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Discussion.—Mr. I. W. MAGILL said that he had been responsible for advocating the use of cocaine in connection with intubation and also to diminish throat reflexes, even when intubation was not performed. He had found the method extremely useful, and had not noticed any untoward results in connection with it.

For the operation of tonsillectomy, the majority of surgeons required a condition of quiescent reflexes for the operation. This could be brought about in two ways: Firstly, by deep ether or chloroform anæsthesia; secondly, by surface anæsthesia with cocaine, combined with light general anæsthesia.

It should be remembered that tonsillectomy was now performed not only for hypertrophy, or for strictly local defects, such as recurring attacks of inflammation; it was frequently an attempt to eradicate possible sources of focal sepsis in patients affected with other diseases. It would seem logical to limit the amount of ether and chloroform in such cases if possible. Mr. Negus had clearly shown that the risk of blood entering the trachea was a very definite one, even with a pillow below the shoulders. The protection of the patient from this risk was a matter of great concern to the surgeon. A modified "Trendelenburg" or intubation and packing would help in this direction.

Section of Medicine.

President—H. Morley Fletcher, M.D.

[*April* 25, 1933.]

Bacteriæmia in Pneumonia.

By G. J. Langley, M.D.

Abstract.—(1) Tables are shown which record the course of bacteriæmia investigated by frequent blood-cultures in a series of cases of pneumonia.

(2) The proportion of cases having a bacteriæmia in the course of the disease agrees fairly closely with other findings both in this country and in America.

(3) Attention is drawn to the frequency with which the organisms disappear from the blood in the absence of any specific treatment, and to the frequency of recovery of bacteriæmic cases.

(4) It is therefore submitted that it is unsafe to regard the disappearance of a bacteriæmia as the direct result of specific serum treatment, and that this cannot be used as evidence of successful serum therapy.

The mortality from pneumonia maintains so high a level as to demand every effort to reduce it. That such an effort is being made is amply shown by the vast literature which the past thirty years has provided.

During this period the bacteriæmia accompanying the disease has become more and more prominent, first as an aid to prognosis and later as an estimate of the efficiency of treatment. In a paper published by Rosenow [1] in 1904 this subject of bacteriæmia in the disease was reviewed and the results of several observers, from various countries, were recorded. It will be seen from Table I copied from his paper, that wide differences occur in the percentage of positive findings, and that the mortality, where quoted, is not definitely related to the blood-positive incidence. Rosenow studied 145 cases, in which the organism was recovered from the blood 132 times, giving 91% positive with a mortality of 40%. In two cases the organism was seen in blood-films but failed to grow. In four cases the temperature had been normal for twelve or more days before culture was made; in two cases a sterile culture was obtained on the second day of the disease, while the same occurred on the day of crisis in two cases. In Rosenow's opinion there was only one case in the series in which a sterile blood was difficult to explain, and he therefore regarded bacteriæmia as constant in the disease and of no prognostic significance. At this time no typing of the organism was possible and no diagnostic serum existed.

Table I.

Rosenow, E. C.

Studies in pneumonia, Journ. Infect. Dis., 1904, Vol. I, p. 280.

Review of literature—Blood-culture.

Date	Name	No. of cases	Result	Positive
1890	Banti ...	29	—	18
1894	Libman ...	16	6 deaths	6 2 in smears only
1894	Kühnan ...	9	3 deaths	1
1897	Kohn ...	32	9 deaths	9
1897	Nazare ...	7	—	4
1898	Serini ...	23	—	3
1898	Sello ...	48	19 deaths	12
1899	Pieraccini ...	28	—	11
1899	White ...	19	10 deaths	3
1899	Baduel ...	57	—	55
1899	Berghieri ...	8	—	8
1900	Silvestrini and Sertoli	16	—	15
1901	Pässler ...	38	all recovered	1
1901	Procbaska ...	50	12 deaths	50 only one culture 10 c.c. blood
1902	Cole ...	30	13 deaths	9

Rosenow studied 145 cases. Positive results in 132.

The early work of Neufeld and Haendel [12] was carried much further by Avery and his colleagues [13], so that by 1928 the typing of the organism into four groups was a commonplace and Rosenblüth was able to record the results of systematic blood-culture in 500 cases of pneumonia [2]. He drew attention to the fact that although Prochaska and Rosenow had obtained positive results in over 90% of cases, yet Schottmuller, in common with Cole and his colleagues, had failed to reach 30%. The figures obtained by Rosenblüth are similar to those found by many other observers, Type I giving rather over 30% with Types II and III rather less and Group 4 under 10%. It would therefore appear that the early high figures could not be accounted for by any of the recognized groups. There still remains, however, a considerable variation in the proportions found by different observers, as is shown in Table II. It follows that where a high percentage of blood-positive cases is found there will be no relation to mortality, whereas with lower percentages such a relation might well exist. Table III is designed to show this relationship.

The great majority of this work has been done in America, where the death-rate returns are 30% higher than in this country, and it therefore becomes important to know how far the American figures and findings are applicable here. In judging of this matter it is also important to remember that the mortality rate varies to a considerable degree in the various hospitals even in New York. This would appear to depend, as indicated by Cruickshank [3], upon the type of case admitted, for the mortality seems to be higher in the American coloured community than in the whites.

TABLE II.

PERCENTAGE OF POSITIVE BLOOD-CULTURES.

Type	Rosenblüth [2]	Cecil, Baldwin, Larsen [5]	Rockefeller [3]	Cecil, Plummer [4]	Park, Bullowa, Rosenblüth [10]	Cruickshank [3]	This series
I	35	26	50	30	25	37	33
II	31	41	49	51	20	34	40
III	25	28	16	—	—	4	nil
Gr. 4	8	16	21	—	—	9	8
Cases	490	326	448	4,310	Type I-214 Type II-117	329	200

Other factors readily occur to the mind, for it has long been known that mortality rises rapidly in age-groups over middle life. Variations in the virulence of the organism under differing conditions is a possibility, but bacteriological workers for some time past have recognized a standard which would seem to make this factor an unlikely one. There remains the unknown factor of widely differing resistance in various groups of the community. It is possible that variation in results might arise from differences in technique or in the criteria for the recognition of the pneumococcus. So far as the latter is concerned, diagnostic sera for the three fixed types will eliminate such a factor, which will only therefore be operative in Group 4.

Cultural examination of the blood in pneumonia patients varies in the clinics both in the volume of blood used and the frequency with which it is made. In the records the volume varies from three up to ten cubic centimetres; some is always put into broth, and a measured quantity is often put into agar for enumeration. Such cultures are made most usually on the patient's admission to hospital, but are not repeated unless the first culture prove positive, or the progress of the patient is found unsatisfactory. Such a method of inquiry would make the finding of a positive culture more and more likely as the severity of the infection rose.

All observers are agreed as to the greater gravity of the disease in the bacteriæmic cases, and Cecil [11], in summarizing, says, "In the struggle between the pneumococcus and the human host, septicæmia spells death."

TABLE III.

EFFECT OF BACTERIÆMIA ON MORTALITY.

Type	Rockefeller [3]		Park, Bullowa, Rosenblüth [10]		Rosenblüth [2]		Cecil, Baldwin, Larsen [5]		Glasgow [3]		This series	
	Bl. pos.	All cases	Bl. pos.	All cases	Bl. pos.	Bl. neg.	Bl. pos.	Bl. neg.	Bl. pos.	All cases	Bl. pos.	Bl. neg.
I	26	11	56	25	81	16	72	15	15	11	40	8
II	73	28	64	26	75	21	90	16	52	21	60	48
III	100	43	—		85	17	80	41	100	40	—	
Gr. 4	52	9	—		100	8	93	16	66	9	50	9

That such a statement is not strictly true is shown in Table III, but it would appear that the mortality in all types of pneumococcal infection rises greatly when bacteriæmia occurs. Yet it is impossible to accept these figures without a careful consideration of the method adopted, which would appear to favour a positive finding in certain selected groups. The day upon which the majority of the patients were admitted to hospital would manifestly affect the figures, and to repeat the blood examination because the patient is doing badly, while omitting to do so when things go well, may be good practical medicine but cannot be regarded as good scientific inquiry. By the terms of such an inquiry all the severe cases are much more fully investigated than the mild ones, and are by that amount the more likely to give positive results. It would seem a simple matter to make a blood examination daily in every case throughout so short-lived an infection as pneumonia, but the number of opportunities available to culture on the first day of the disease is almost limited to such cases as arise in hospital, and this number would always be small.

Table IV.—In a paper published by Koch [7] last year the opinion was expressed that division into positive and negative blood-culture cases was too arbitrary, and that much might be learned from the degree of bacterial invasion. He had therefore studied 139 cases in the first five months of 1931, of which 45 gave a positive result (32·4%), 18 being Type I and 22 being Type II. He showed that in 20 cases there was an increasing bacteriæmia and all the patients died, while 12 cases with a falling count gave only two deaths. It is further to be noticed that increasing bacteriæmia was an event occurring after the third day, while decreasing bacteriæmia arose before the end of the third day in all but one case. He further found that a bacteriæmia of over thirty organisms per c.c. was always fatal. In his inquiry 3 c.c. of blood were taken, two of which were put into broth, while the third was plated on to agar for counting.

TABLE IV.

Koch,[1] in the first five months of 1931, studied 139 cases of pneumonia. Positive blood-cultures were obtained in 32·4 %. The mortality rate was 75 %.

Type incidence in positive cases.

Type		Cases		
I	...	18		
II	...	22		
Gr. 4	...	5	...	Total 45

Increasing bacteriæmia.

Type		Cases		Result
I	...	10	..	all died
II	...	9	...	all died
Gr. 4	...	1	...	died

Decreasing bacteriæmia.

Type		Cases		Result
I	...	2	...	one died
II	...	9	...	one died
Gr. 4	...	1	...	recovered

Bacteriæmia		Before third day		After third day
Increasing	...	6	...	14
Decreasing	...	12	...	1

1 *Amer. Journ. Med. Sci.*, 1932, clxxxiv, 364.

A somewhat similar study had been made by Dochez [8] in 1912 when no serological typing was available.

A further series was recorded by Sutton and Sevier [9] in 1917 and I have taken the liberty of transcribing their results into a different form. In their series 66 cases were studied with positive results in 21 cases. It will be remembered that at this date the serological typing was uncertain with regard to Type II, and that therefore the group so recorded by them would now probably be regarded as the American Type V. It is proposed to show their figures for comparison, beside the figures so obtained in a study of 288 cases made during the past eighteen months, of which 136 have had multiple blood-cultures made.

The findings in this series are shown in Table V.

TABLE V.

Total cases studied. 288 in 18 months.

Cases studied by multiple blood-cultures. 136.

Type	Cases	Positive	Percentage
I	79	26	33%
II	30	13	43%
Gr. 4	27	2	7%

Positive blood-cultures.

Type	Lived	Died
I	16	10
II	5	8
Gr. 4	1	1

Cultures made.

Type	Number	Positive
I	300	15%
II	95	17%
Gr. 4	77	3%

Deaths.

Type	Number	Positive
I	14	10
II	15	8
Gr. 4	3	1

The precise method which has been adopted is as follows:—

These cases are admitted to Hope Hospital, Salford, which is administered by the local public assistance committee; the class of patient is not distinguishable from that found in the voluntary hospitals. The study was limited to patients between the ages of 16 and 60, and an endeavour was made to carry out daily blood-cultures, but the figures will show how sadly this fell short. Blood was taken from an arm vein into a 10-c.c. syringe and about 3 c.c. was introduced into each of two large culture tubes containing 10 c.c. of broth. Contamination occurred in about 1% of samples. The medium used was a 1% glucose hormone broth, standardized to pH 7·4, and containing 0·2% sodium citrate. Incubation and examination were continued for three days. Agglutination tests were carried out by means of serum used in a dilution of 1 in 50.

Where the Group 4 organism was concerned, before it was accepted, it was proved to be bile-soluble, non-granular in broth, hæmolytic of the viridans type, and highly pathogenic to mice. Capsulation in the first culture was also examined.

In spite of the frequent repetition of blood-culture, it will be noticed that the proportion of positive results is not so high as those of some other observers, and that although the mortality of Type I is low, that of Type II is very high. Type III in this series has only been seen twice, and on each occasion the patient has died within twenty-four hours of admission to hospital.

From the records of Table VI it will be seen that cases in which the patients recover, in spite of a positive blood-culture, are not necessarily those in which it has occurred early in the disease, nor those in which a positive result has been

found only once, nor those in which crisis has occurred early. Comparison with the figures of Sutton and Sevier gives the impression that there is a dissimilarity between the two groups of cases and that the patients in this series are better able to recover than those in America.

TABLE VI.

POSITIVE BLOOD-CULTURES. TYPE I.

Sutton and Sevier. J. H. H. Bull., 1917.

Case No.	Day of disease 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Result
1	−	−	+	+	+	−	−	−								R
2			−	+	−	−	−	−	−	−	−	−	+D			D 13
3				+	−	−	−	−	−	−	−	−				R
4				+	+	−	−	−	−	−						R
5				+	+	+	−	−D								D 8
6					+D											D 5
7					+	+	+D									D 7
8							+D									D 7
9							+	+	+D							D 9
10				+	−	−	−	−								R

October, 1931, *to March*, 1993.

Case No.	Day of Disease 1	2	3	4	5	6	7	8	9	10	11	12	13	14	Result
1/87												+	+	−	D 19
1/96		+	+		−	−		+D							D 8
1/104						+		+D							D 8
1/105			+	+	−	+									D 27
1/113				+		+			D						D 9
1/125						+		−	−	−C	−				R
1/139				−		+	+	−			−			L	R
1/146									+C					−	R
2/15						+	−	+	+	−L		−			R
2/16					−	−	+	−	D						D 8
2/22			−	−		+	C					−			R
2/38					+	−	+D								D 7
2/40					+	−	−	−C	−						R
2/51						−	+	+	−	−C					R
2/52				+	−	D									D 6
2/53					−	+	negative to crisis on 22nd day								R
2/55										−	+D				D 11
2/69			+	+	+	−	−	−C							R
2/83						+	−	−	C						R
2/85			+			+		D							D 8
2/90			+	+			−	L	−	−	−	−			R
2/92			+		−			-		C					R
2/105			+	−	−	−	C								R
2/107			+	+	−	−	C								R
2/109		−	+		−	−	−			−	−	C			R
2/114			+	+			+		+			−	−	−	R

Table VII sets forth the findings in Type II and Group 4 cases, and so far as the second type is concerned it is to be noticed that in all cases in which the patients survived the organism had only been recovered from the blood once, although the day of the positive finding might be early or late in the disease.

TABLE VII.

POSITIVE BLOOD-CULTURES. TYPE II, ATYPICAL.

Sutton and Sevier. J. H. H. Bull., 1917.

Case No.	Day of disease 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Result
1			+	+ D												D 4
2			+	−	−	−	−	−	−	−						R
3				−	+	+	−	−	−	−						R
4				−	−	−	+	−	−	−						R
5			+	+	+D											D 5
6										+	+D					D 11
7						+	+	+	+D							D 9

POSITIVE BLOOD-CULTURES. GROUP 4, *as above.*

Case No.	Day of disease 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Result
1			−	−	+D											D 5
2			−	−	−	−	+D									D 7
3			−	−	−	−	−	+	+	+	+	+	+	+	+ D	D 16
4									+	+	+D					D 11

POSITIVE BLOOD-CULTURES. TYPE II.

October, 1931 *to March*, 1933.

Case No.	Day of disease 1	2	3	4	5	6	7	8	9	10	11	12	11	14	Result
1/10						+	−	−							R
1/13		+	+				D								D 7
1/132			−	+		−		L							R
1/034			−		+	−			C						R
2/34		−		−			+	−				−	L		R
2/41					+	D									D 6
2/76						−	−	−	+	−	−	−			D 12
2/77				+		D									D 6
2/89			+			+	+	D							D 8
2/74	−	+	D			relapse from a previous attack T. 2									D 3
2/117		−	+	−	−			−	−						R
2/123				+		D									D 6
2/124							+		D						D 9

POSITIVE BLOOD-CULTURES. GROUP 4.

October, 1931 *to March*, 1933.

Case No.	Day of disease 1	2	3	4	5	6	7	8	9	10	11	12	13	14	Result
2/49								−	+			−	−C		R
2/95			+	D											D 4

From the clinical standpoint it is probably true to say that the patients in most bacteriæmic cases are more gravely ill than those in which a positive blood-culture is not obtained, yet it is not all the severe and lethal infections which show this phenomenon and any bedside opinion as to blood-positive or negative is likely to prove wrong.

The result of this investigation shows that bacteriæmia is not necessarily lethal, but that it makes the prognosis much more grave. At the same time it is manifestly not possible, at least in this country, to argue that a reduction or removal of a previously demonstrated bacteriæmia is the direct result of specific serum treatment, for it is shown to occur relatively frequently in the absence of any specific treatment.

No attempt was made to arrive at an estimate of the numerical degree of the blood infection and it may be well to point out here the great difficulty of such work. If it be accepted that Type I pneumonia constitutes 30% of the cases, and that of these again 30% will show a positive blood-culture, then it will be necessary to investigate 1,000 cases of pneumonia before an opinion based upon 100 cases with organisms in the blood can be obtained. This, in turn, will involve the making of something like 6,000 blood-cultures, and in a service providing 200 pneumonias per year will occupy well over five years.

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The Action of Artificial Pneumothorax on the Lymphatics of the Lung.

By Reginald Hilton, M.D.

This is a short experimental study on animals, undertaken as part of a general inquiry into the mode of action of artificial pneumothorax.

The method used was as follows: Up to 3½ c.c. of a heavy suspension of fine carbon particles were injected into the trachea of rabbits, under urethrane anæsthesia, and one lung was immediately collapsed by pneumothorax. Sterile liquid paraffin was also injected, so as to obviate too frequent refills. Twelve animals have been successfully so treated, and have been killed at intervals of up to six months. The lungs of those killed earliest show that the carbon is deposited so heavily over both lungs that they look deep black on their pleural surfaces. The distribution of the carbon is usually heavier on one side than the other; artificial pneumothorax has therefore been done on alternate sides in successive experiments. In certain cases some of the carbon leaks from the hole in the trachea, and if too high a pressure is used for injection, the fluid returns into the mouth. Such animals have been excluded from the series because it was found that only by the injection of an adequate quantity could one be sure that both lungs were getting a fair dose of carbon.

In two control animals left for four months without pneumothorax most of the carbon has, at first sight, been removed from the lungs. On histological examination, however, it is surprising to see how many alveoli still contain particles of carbon. The collapsed lung contains much more carbon than the working lung. This is seen on the surface, but more strikingly on section. Because of the difficulty of knowing how much carbon was originally distributed to each lung, it is not safe to stress the superficial appearance. The important point is the distribution of the carbon histologically. The lymphatics contain masses of carbon, especially towards the hilum, and they are grossly dilated on the side of the pneumothorax. This striking appearance of dilated lymphatics filled with carbon has been seen only in the collapsed lung. The alveoli also contain more carbon than in the working lung. The latter naturally shows carbon in the lymphatics and some in the alveoli, but in no case in these experiments have they shown more than relatively a small fraction, nor does one ever see in the working lung the gross dilatation of the lymphatics seen in the collapsed lung. It seems evident that collapse of the lung has largely prevented the removal of the carbon as compared with the opposite lung.

It is difficult to see any cause of dilatation of the lymphatics in a healthy lung other than mechanical obstruction. If such obstruction did not occur, collapse of the lung would be expected to close lymphatics as it does capillaries, and not to enlarge them. It appears that such part of the carbon as is normally removed into the lymphatics accumulates in these vessels in a collapsed lung. Any difference due to pneumothorax in the proportion of carbon transported by the two available routes, to the lymphatics and to the exterior via the bronchi, cannot explain the dilatation of the lymphatics which is the principal part of the picture described. Presumably there is some sort of kinking in the main lymphatic vessels near the root of the lung: whatever it is, it must be operative at once, because the difference in carbon content of the two lungs is noticeable after a few weeks.

In human lungs which have been collapsed for a considerable time, an increase of collapse and early fibrosis can be seen round the lymphatics, which also present this dilatation very definitely. This appearance has been described by Leroy Gardner, and it is reasonable to suppose that, whatever the differences between the rabbit lung and human lung, there must be lymphatic stasis in both, with consequent hindrance of absorption from the lung.

We may now ask if this process of lymphatic block plays any part in the result of a therapeutic pneumothorax. The mode of action of pneumothorax, for instance in tuberculosis, is not fully understood, involving as it does, besides absence of respiratory movement, profound changes in the blood and lymph circulation through the lung (as the writer attempted to show elsewhere). But we do understand something of the part played by the lymphatics in the spread of tuberculosis. There are, according to the work of Miller, no lymphatics in the walls of the air spaces distal to the ductuli alveolares. Such tubercle bacilli as gain admission to the beginnings of the lymphatic plexus do so within a phagocyte, as carbon does. It would seem probable that the transference of tubercle bacilli along the lymphatics will be slowed by lymphatic stasis and the chance of metastatic infection will be diminished. It is generally admitted clinically that an effective collapse of the lung lowers the risk of spread of the disease.

There is another clinical phenomenon for which one attempts to find an experimental explanation. That is the striking effect on the temperature and general condition often seen in febrile patients within quite a short time of the beginning of an effective artificial pneumothorax for unilateral tuberculosis. This effect may occur in a time too short to have brought about any bearing on the tuberculous process itself. The idea of the mechanical prevention of absorption of some toxic agent or substance is an obvious one, and from these experiments it appears possible to suggest that lymphatic obstruction plays an important role in bringing about this symptomatic improvement. It has been often stated that the benefit of artificial pneumothorax is proportional to the degree of collapse obtained, but if benefit may be derived by preventing absorption from a tuberculous lung it is likely that the greater the degree of collapse obtained the greater will be the lymphatic stasis and the less the absorption by the lymphatic route.

Whooping-cough in Old Age.

By A. J. Hall, M.D.

Although whooping-cough is more strictly confined to the first five years of life than most other specific fevers, yet it may occur at any age; quite a number of cases are recorded in persons over sixty. Elliotson [1] in 1839 in his Textbook of Medicine, states that "The late Archbishop of Canterbury had it shortly before death." This must have been Charles Manners-Sutton who died in 1828 at the age of 73, concerning whom the *Dictionary of National Biography* says, "The very year of his death he was too ill to attend (The House of Lords) in person . . ." Probably this was owing to the attack to which Elliotson refers. Gibb [2] in his monograph on "Hooping Cough" (1854) mentions a case seen by Roe in a woman aged 65, and refers to one reported in the American Press, a Baltimore man, who had it when aged 76. Todd [3] in 1854 reported cases in a married couple, aged 80 and 72 respectively. Both recovered. Heberden [4] met with one case in a woman, aged 70, and another in a man aged 80. It is common knowledge that the eminent physician referred to in Fagge and Pye-Smith [4] as suffering severely from an attack when more than 65 years of age, was the late Sir William Jenner. Sticker [5] quotes Veldon as seeing a case in a man of 70. Hale-White [6] reported a case in a remarkably healthy woman, aged 81. Whilst in his consulting room she had more than one paroxysm with typical whoops. There were no signs of bronchitis. Schwenkenbecher [7] records how his own mother, aged 66, came to stay with them. She had a severe cough and infected her youngest grandchild. He also mentions the case of a young adult infecting others, including a mother, aged 66, and a father, aged 80.

I have been surprised at the number of cases which I have heard of in the course of recent casual conversations with colleagues. These include a well-known consultant in children's diseases—now no more—who had it when getting on for 60 years of age; a distinguished Oxford fellow, who had it when 76, recovered and lived to 86; two cases in which old ladies visiting their grandchildren have been infected by them.

If one adds to the recorded cases the probably much larger number not recorded, and also the possibly quite considerable number not diagnosed, it would seem to be less uncommon in old age than is generally thought.

As whooping-cough is not notifiable it is impossible to say what proportion of the population suffer from a primary attack in childhood. It cannot be large, and as few suffer from it when childhood is over, it would seem that a certain natural immunity develops spontaneously with the body's growth. In most people this seems to be sufficient to protect them. In a few, however, it is not, and in young adult life they become infected on sufficient exposure. This is not an uncommon thing in young medical men. One of my colleagues had it whilst registrar at his hospital. Even the immunity acquired by an attack in childhood does not always continue through adult years. I have the notes of a severe case in a medical woman aged 35, the result of an infection at a welfare clinic. She had had a severe attack when seven years old which was vouched for by the medical man who attended her in both instances. J. D. Rolleston [8] saw it in a nurse, aged 21, who had had a previous attack at 5 years of age.

Whilst then it is possible for primary or secondary attacks to occur on exposure in young adults, it is particularly to the cases in old age that I wish to call attention.

These may be divided into two groups: (A) Those in which there has been a known attack in childhood. Such cases have been recorded by Lühe [9] and Widowitz [10] up to the age of 81. In these an acquired immunity has evidently been lost.

(B) Those in which there is no definite information one way or another as to an attack in childhood.

If these had had an attack they obviously come under Group B (*a*), and it is merely a question of loss of an acquired immunity. If they had not, there are two possible explanations, either: (1) They have never at any time been immune and have only escaped earlier in life from lack of exposure to infection; or (2) they have been naturally immune throughout the greater part of childhood and adult life, but have lost this natural immunity in old age.

Of the five cases belonging to Group B which I have met with in practice, two present certain features which make the second alternative highly probable. Thus neither of the patients is known to have had a primary attack in childhood. Both have undoubtedly been fully exposed to infection during adult life without effect. Both became infected in old age.

Case I.—Dr. X., aged 72, a general practitioner of more than forty years' standing, began with a cough early in January of this year. On January 21, whilst in the street, he had a paroxysm of coughing of such violence that he had to stand still and thought he would never get his breath again. During the paroxysm he felt a sudden severe pain in the left side which proved to be a ruptured external oblique. The side was strapped, but similar violent paroxysms of coughing recurred at frequent intervals, causing severe pain. I was not asked to see him until four days later. His condition then was most distressing. He had been unable to lie down since the day of the attack, because to do so brought on the paroxysmal cough. He could only sit in his chair or kneel on the floor and lean over a low couch. He had not had more than a few minutes' sleep at a time for four days and nights, as the cough always wakened him. He described a paroxysm as follows: It seemed to begin with a fibrillary twitching in the left upper abdominal muscles, these then went into a spasm and he could not take a breath. This spasm lasted so long that he felt that he would never be able to breathe again. He became cyanosed and then quite suddenly everything relaxed. He

brought up a small pellet of mucoid sputum, and the attack was over. Between the paroxysms he was in no distress, except for the pain in the side. He was able to take food. The temperature was not raised, and the pulse was only 72. My diagnosis was whooping-cough, but with this he did not agree. During the next few days, in spite of large doses of sedatives and narcotics of almost every kind, together with various "specifics for pertussis," no relief at all was obtained either from the frequent paroxysms or from the insomnia. On January 27 his legs began to swell, and he was, with difficulty, persuaded to get into bed for a while. From January 27 to February 1 the paroxysms became somewhat less frequent; he was able to get occasional snatches of sleep, but never for more than half an hour day or night. The ruptured abdominal muscle also was less painful. On January 29 the temperature rose to 100° F. at night. On January 31 it was 102° F. One night, during which he had several severe paroxysms of coughing, a large ecchymosis developed, extending across the lower abdomen, another in the lumbar region, and a third over the buttock. About this time he was also slightly delirious at times, and his general condition was rather disquieting. On February 1, having accepted the diagnosis of whooping-cough, he asked for a hypodermic injection of adrenalin which, he assured me, he had always found to be a "specific" in this disease! For many years he has had a particularly wide experience of whooping-cough in connection with a public appointment. After the dose of adrenalin he was for two hours without a paroxysm; this was the longest interval of freedom he had had for ten days. The same evening when I saw him he said that he felt much better and that he could now take quite a full breath. This level of improvement, however, was not maintained, and during the next few days, although the paroxysms were less frequent, he became greatly exhausted from lack of sleep. His legs became rather more swollen. During this time the nurse reported quite definite "whooping" on two or three occasions. On February 5, two weeks after the first paroxysm, he began to get a little more sleep, and during the next few days improved steadily in every way. On February 9 he was up, dressed and practically convalescent. He is now back at work as usual, though he still has occasional slight paroxysms.

Whilst there are many features of interest in this case, such as the ecchymosis, the temporary œdema of the legs, the question as to the value of adrenalin, and the rupture of an abdominal muscle during a paroxysm, which occurred in two of my adult cases, time does not permit of discussing them. I will limit myself to this question of loss of immunity.

Dr. X. comes under Group B. He does not know whether he had pertussis in infancy or not. Had he been a layman and acquired it at the age of 72, it might have been explained as being due to his first serious exposure to infection. Seeing, however, that for over forty years he has been constantly attending such cases in large numbers, it is difficult to believe that he should have escaped infection for all that time had he not been immune during most of his life, whether such immunity was natural or acquired. At the age of 72, although so far as we know he has not been in any way more exposed to the infection than at any other period of his life—his immunity has failed.

A second case which points in the same direction came under my notice twenty-five years ago.

Case II.—Mrs. B., aged 73, was seen in consultation with the late Dr. Shea, of Chesterfield in January, 1908. Five weeks previously she had begun to have her usual winter cough, and three weeks later, on Christmas day, paroxysms of great violence began. They usually came on in the early morning, waking her out of sleep; occasionally there was one in the day also. She described the attacks as being "just like whooping-cough." She said it felt "as though there was a net-work in her throat which could not be moved either way, and as she struggled she became bluer and bluer, and severe pain came over the heart and down the left arm. Eventually nothing but a little frothy sputum comes up. After an attack she was exhausted and swollen. My record gives no information as to whether she had had pertussis or not in childhood, and therefore as in the previous case, she comes into Group B. That she had been immune in younger adult life is, however, exceedingly probable, because she had been heavily exposed to infection whilst nursing one of her children who died from it. Indeed,

it was from the recollection of her child's attacks that she had herself diagnosed her condition —a diagnosis with which her doctor did not at first agree. However, there was no doubt as to the correctness of her suspicions and there was a definite history of exposure, a fortnight before her attack, when she had visited a house in which the father and five children were suffering from it.

Although this woman had probably much fewer opportunities of becoming infected than Dr. X., yet it is reasonable to suppose that in the course of nursing her own child in a fatal attack the amount of exposure was considerably greater than that to which a medical attendant is subject. At 73 she is affected after what was, at most, a brief—and not very intimate—contact with a case. She made a complete recovery in a few weeks.

Of the three other cases of whooping-cough which I have seen in advanced years, one was in a man aged 67, in whom the paroxysms led to vomiting. In spite of a supposed "heart trouble" he made a complete recovery in four or five weeks. Another was in a woman aged 65. In this case also the paroxysms caused vomiting. She, too, recovered completely. The third was in a woman aged 58. In her case a paroxysm was often set up by taking food; in fact, some œsophageal obstruction was at one time suspected, but a radiogram showed that there was no abnormality in the œsophagus. She had definite inspiratory whoops. Unfortunately in none of these cases is there any statement as to whether there had been an attack in childhood or not.

As regards the question of loss of acquired immunity in whooping-cough, Widowitz [10] says:—

> "Most whooping-cough patients obtain lifelong immunity . . . it always confers immunity up to a certain age, according to my experience about 30 years of age. After this recurrences are not uncommon."

This statement refers only to cases of immunity acquired from a previous attack. As to whether there is such a thing as natural immunity, and if so at what age it tends to disappear, I have been unable to find any opinions expressed.

There are certain points of practical importance if the views brought forward in this paper are correct.

(1) The possibility of whooping-cough as a diagnosis should be borne in mind in every case of severe paroxysmal cough in an elderly person, for which no obvious organic cause can be found.

(2) The popular idea that old people, whether they have it in childhood or not, may with safety be brought in contact with cases of whooping-cough in children is incorrect.

As regards susceptibility to whooping-cough, old age appears to revert to childhood. Indeed, in respect of its tendency to attack the extremes of life, or perhaps its less capacity to attack active youth and adult life, whooping-cough shows certain similarities to bronchopneumonia.

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Discussion.—Dr. J. D. ROLLESTON said that though he had had considerable experience of whooping-cough, he had never seen a case in old age, and his knowledge of the subject was merely derived from perusal of the literature. The only examples of the disease which he had seen in adult life had been a nurse who had had a second attack at the age of 21, her first having been at the age of 5 years, and a woman aged 50, who had been under his care only a month previously. In both cases the symptoms of whooping-cough had been typical. The subject of whooping-cough in old age was of interest from both the epidemiological and the clinical standpoints. Owing to the atypical form which it often assumed at that age it frequently passed unrecognized, and so old persons might be responsible for the spread of the disease. Several writers on whooping-cough in adults emphasized the absence of certain symptoms, especially vomiting. The earliest cases on record of whooping-cough in old age appeared to be those reported by William Heberden the elder, in 1802, in a woman aged 70 and a man of 80. The oldest patient was that described by Petit, a man aged 92, and the next oldest was Boulting's case in a man aged 84. In both cases recovery was uneventful.

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Section of Neurology.

President—J. S. Risien Russell, M.D.

[*May* 18, 1933.]

The Degeneration of the Brain in Chronic Alcoholism.

By Ettore Marchiafava.

(*Professor Emeritus in the University of Rome.*)

My purpose in this communication is to make known the work that has been done in Italy on those alterations in the brain which are considered to be characteristic of chronic alcoholic intoxication; but of which, so far as I know, there has been no confirmation whatever, up to the present, in any other country, although the first publication on the subject was issued thirty years ago.

It is known to all physicians that in chronic alcoholism, in association with alterations of the organs of vegetative and sexual life, there often occur alterations of the nervous system, with psychical and neurological symptoms, described in books on psychiatry and neuropathology. These books describe also the anatomical alterations, such as degenerative changes in the cortical vessels, small hæmorrhages, minute foci of softening and degenerations in the cells and nervous fibres, with proliferation of the neuroglia in the brain, cerebellum and spinal cord. There are also the various researches on the nervous centres of animals intoxicated with alcohol.

We are now able to assert that in the brain of man, in a condition of chronic alcoholism, some alterations may be present which, from their location, can be judged as specific of chronic alcoholism, like the degenerative alteration in the posterior columns of the spinal cord in locomotor ataxy.

These changes have been studied in the Institute of Human Pathology of the University of Rome, after my first observation made in 1897 on an alteration of the corpus callosum, then described for the first time, and found at autopsy in the brain of a man known to be a chronic drinker, whose case was diagnosed as dementia alcoholica; and later in the brains of two other cases of chronic alcoholism.[1] Subsequently Bignami and Nazari made further observations, which revealed other localizations of the same alteration in the brain, with histological researches and original pathogenetic interpretations. All the observations and researches of these authors were amply described in a publication in 1915.[2] The number of cases of these alterations of the brain observed up to the present is over forty. The greater number of cases was observed by A. Nazari in the Hospital of S. Spirito in Rome.

The principal change, first observed, and the most constant and characteristic, serving as a guide to the finding of other existing alterations, is a grey degeneration, localized in the two commissures, the corpus callosum and the commissure anterior, precisely in their median layers, limited by two normal white layers, superior and inferior. In the corpus callosum the degeneration extends from the genu to the splenium, and on the sides to the corona radiata. The area of degeneration is hidden, when one observes the corpus callosum from above, by the dorsal normal layer, between the superior part of the two hemispheres. The median

[1] Marchiafava, E. and Bignami, A., "On an alteration on the corpus callosum in chronic alcoholism," *Rivista di Patologia Nervosa e mentale*, Firenze, 1903.

[2] Bignami, A. and Nazari, A., "Sulla degenerazione delle commissure encefaliche e degli emisferi nell'alcoolismo cronico," *Rivista sperimentale di Freniatria*, Reggio Emilia, 1915.

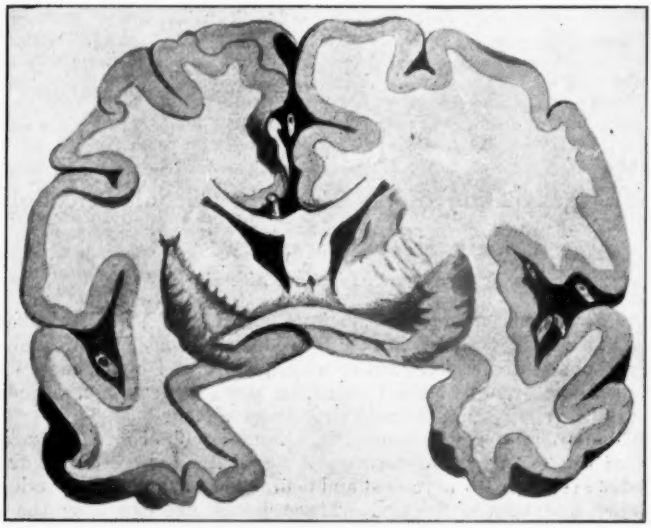

FIG. 1A.—Frontal section of fresh brain including the corpus callosum and anterior commissure. Normal conditions.

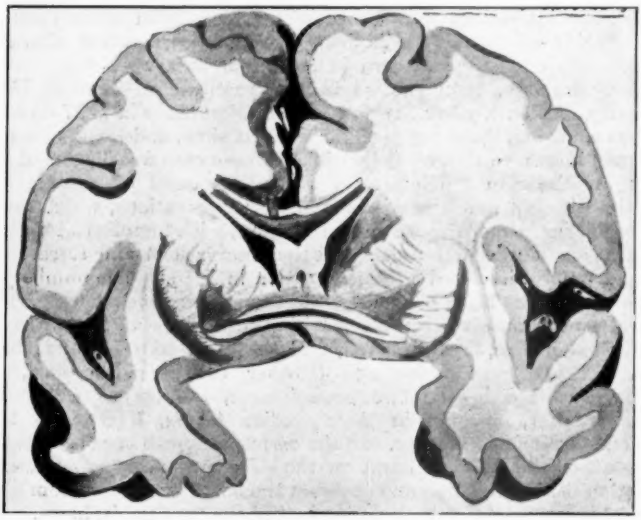

FIG. 1B.—Frontal section of the brain in a case of chronic alcoholism. Degeneration of the median layer of the corpus callosum and of the anterior commissure.

layer of the two commissures, under natural conditions, has a grey pink or grey colour, and on the cut surface is depressed between the superior and inferior layers of normal white substance (see fig. 1).

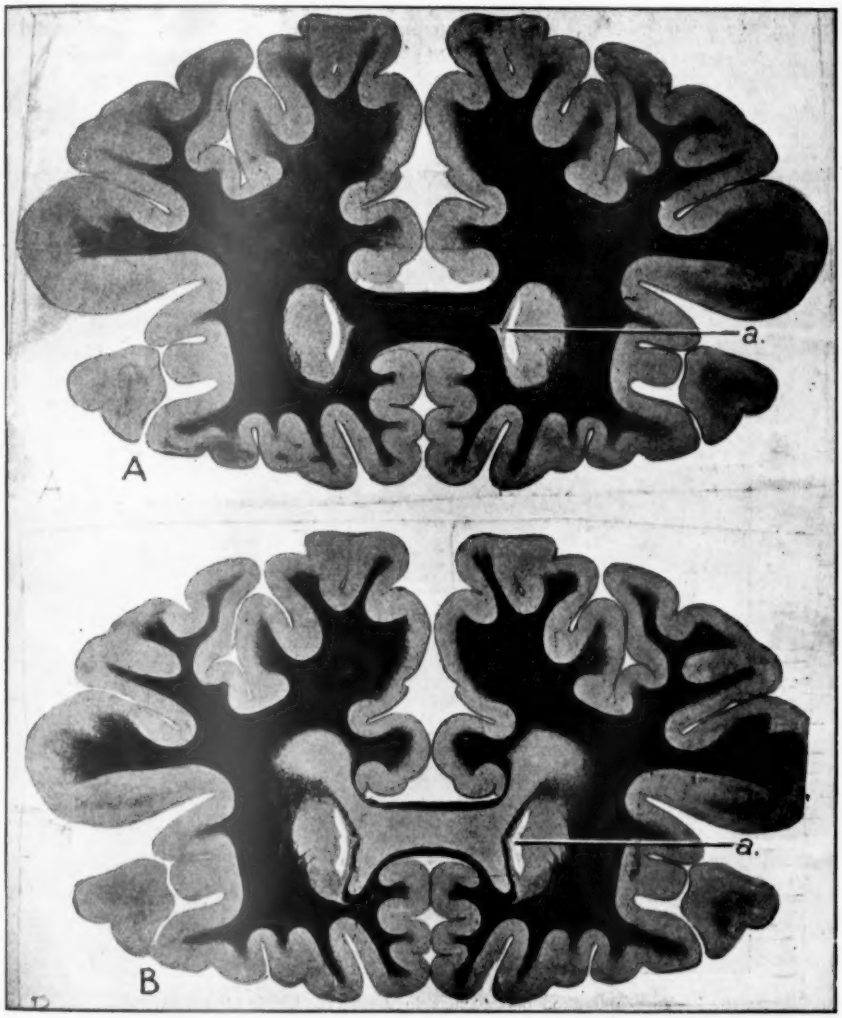

FIG. 2.—Vertical sections of two brains at the level of the frontal lobes, stained by the Weigert-Pal method.
A. Normal condition; *a*, corpus callosum.
B. Chronic alcoholism; *a*, corpus callosum with an ample median layer of degeneration (white) limited by two thin normal layers, dorsal and ventral (dark).

Frontal sections for microscopical examination of the brain, stained by the Weigert-Pal method, show the median layer of the corpus callosum pale, in vivid contrast with the dark blue colour of the two layers, dorsal and ventral, and of other parts of the white substance (see fig. 2).

Sometimes in the corpus callosum the degeneration is disposed in two longitudinal white areas on either side of the dark blue raphé.

Microscopic examination of the degenerated areas shows that the tissue is less compact and more vascular; there is frequently hyaline degeneration of the walls of the minute blood-vessels, which often have a tortuous course. The granule

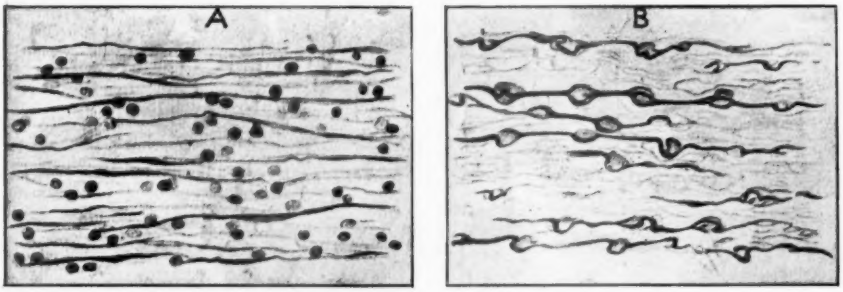

FIG. 3.—Vertico-transverse sections of degenerated layer of the corpus callosum in chronic alcoholism, stained by the Bielschowsky method. Many persistent axis-cylinders with spindle-shaped (A), or pale varicose (B), swellings.

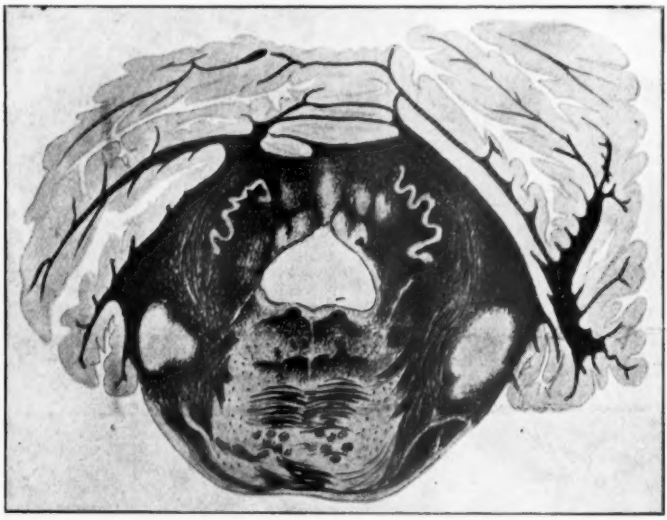

FIG. 4.—Vertical section of the pons in a case of chronic alcoholism, where, in addition to the degeneration of the corpus callosum, were found two symmetrical areas of degeneration in the central part of the two middle peduncles of the cerebellum.

corpuscles, with products of degeneration of the medullary sheaths of the nerve-fibres, are abundant in recent cases, scanty or absent in old ones. In the neuroglia there is swelling of the fibres, without evident proliferation of the cells. The nerve-fibres are degenerated and deprived of the medullary sheath; hence the grey colour of the degenerated areas in the fresh condition and the absence of dark blue colour

in the sections stained with Weigert-Pal. Many axis-cylinders persist, often with irregular swellings.

Our observations on degenerations of the great commissures of the brain in chronic alcoholism have been confirmed in the Insane Asylum of Rome by G. Mingazzini and his assistants; in the Psychiatric Institute of Florence by A. Rossi; in the Pathological Institute at Pisa by Cesaris Demel; in the Pathological Institute at Parma, by P. Guizzetti, and recently in the Pathological Institute at Rome, by F. Guccione.

With the described alterations of the great commissures which, as we have said,

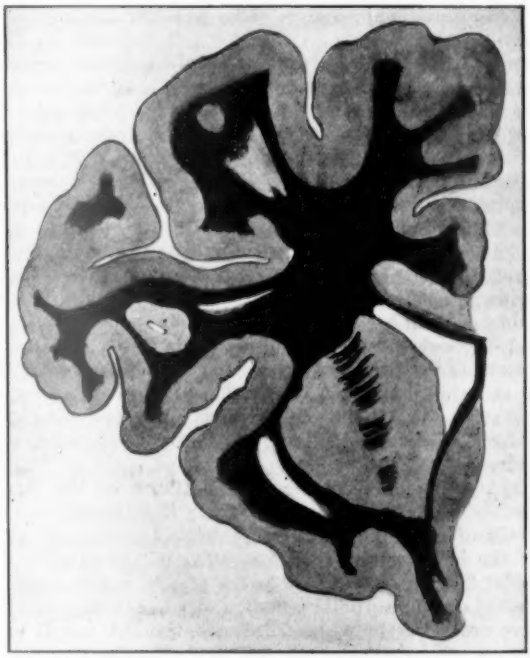

FIG. 5.—Vertico-transverse section of a hemisphere of the brain with degeneration in the corpus callosum to the foot of the corona radiata, and areas of degeneration in the white substance of three convolutions.

are constant and characteristic, and easily recognizable in fresh frontal sections of the brain, there are associated, in some cases, other degenerations in different places. In some cases the presence of two symmetrical areas of degeneration was observed in the central portion of the two middle cerebellar peduncles (fig. 4), and in five cases studied by Bignami and Nazari a symmetrical degeneration of the white substance under the cortex of the two hemispheres was found, in an antero-posterior direction, distinguished in three areas of various extension: (1) fronto-parieto-occipitalis mediana; (2) fronto-parieto-occipitalis lateralis; (3) temporo-occipitalis. The degeneration is most frequently found in the first of these areas (fig. 5).

The histological alterations of the peduncular and hemispherical degenerations are identical with the alterations described in the commissures, with the same persistence of many axis-cylinders, at least for a long period of the morbid process. The degenerations even of a great part of the centrum ovale are not followed by secondary degenerations in the capsula interna and in the pes of the crura cerebri. The degeneration of the white substance of the hemispheres does not involve the fibres immediately under the cortex (the short association fibres, "fibrea propriae gyrorum"), or the foot of the corona radiata.

The alcoholic degeneration of the brain takes its character from its localization in the great commissures, especially in the corpus callosum, a localization which permits the ætiological diagnosis to be postulated from the anatomical observation, because found only in chronic alcoholism and was never absent in all cases observed up to the present.

Now such commissural degenerations are to be considered, according to Bignami and Nazari, as systemic degenerations, on the ground that the morbid process injures tracts of nervous fibres, which have the common functional quality of associating both the hemispheres, although they may also possess different functional properties according to whether they associate symmetrical or asymmetrical regions of the cortex of both hemispheres. And just as in other systemic degenerations, e.g. primary degeneration of the posterior columns of the spinal cord in tabes dorsalis, there may occur an extension of the morbid process to other parts of the nervous system; the same may occur in alcoholic disease of the brain, where, to the systemic degeneration confined to the great commissures, first invaded, other alterations of the same nature may take place in other parts of the nervous centres, as we have already mentioned.

As to the pathogenesis of this degeneration in the commissures, which is a system degeneration, as we have said, if we exclude the secondary origin, vascular or neuroglial, it is natural to think, from the histological alterations, that there is a primary alteration due to the elective toxic influence of the alcohol on the nervous fibres, where, while the medullary sheath is destroyed, the more or less altered axis-cylinders persist.

The clinical symptoms of alcoholic degenerations of the brain, now briefly described in the cases up to the present, over forty in number, were observed in men from 40 to 77 years of age, often with an alcoholic heredity, or alcoholism in the relatives. One of the last cases published in 1929 was observed in the Pathological Institute at Rome[1]. The patient was 32 years of age, a notorious drinker of wine and brandy, who died during a drunken bout, and whose brain autopsy showed, with small degenerative areas in the white substance, the characteristic degeneration of the corpus callosum. Two other cases of alcoholic degeneration of the corpus callosum were observed by Nazari last year, 1932, in the hospital of S. Spirito in Rome.

Some of the clinical histories of the cases are fragmentary, but from those which are complete we are able to construct the clinical course of this alcoholic disease of the brain, the duration of which is long, covering many years. The psychical symptoms—in the mental, affective and moral fields—are never absent and are sometimes predominant; other symptoms are dysarthria, tremor of hands, lips and tongue; ataxy, motor weakness of the limbs, and then epileptiform and apoplectiform attacks, observed with varying frequency, but in almost all cases. Death occurs in a marantic condition, sometimes in an apoplectiform attack or from intercurrent diseases, especially pneumonia, or from accident. The disease may be called "Dementia alcoholica progressiva," to be distinguished from the pseudo-paralysis

[1] "Rivista di Patologia nervosa e mentale," Siena, 1929, vii, Fasc. 5.

alcoholica, curable by interruption of the intoxication with alcoholic beverages, and from dementia paralytica luetica.

I could describe many cases of this alcoholic disease which I, or my colleagues, have observed; but it is not necessary for the purpose of this communication to do so. It may, however, be of interest to recall one case in which the diagnosis of chronic alcoholism was based on the autopsy, and later fully confirmed by the history.

A man, found in the street and carried to the hospital in a drunken state, died suddenly after recovery from the attack while eating, and at autopsy the characteristic alteration was found in the corpus callosum and in the commissura anterior, as in fig. 1. Death was caused by suffocation from a mouthful of meat, too large to pass the pharynx. The pathological alteration brought to mind the probability of an alcoholic ætiology, and from the poor widow, an intelligent woman, we received the following sad history: "My husband was the son of a heavy drinker; when he married me he was employed in a commercial firm, from which he was dismissed for his drinking habits. He then became a fruit grower, and after that an idle vagabond, always a heavy drinker of wine and brandy; irritable, quarrelsome, indolent, sometimes silent, sometimes loquacious, always selfish and unkind to his family. He lost every sense of reserve and decency; he committed obscene actions in front of his daughter, and when I rebuked him he used to beat me—once so cruelly that he was arrested and condemned to prison. After regaining liberty he continued his life as a vagabond and drinker, taking part of my wages by force, and so, getting worse, he began to show a defective articulation of words; he did not keep himself clean and would cry for a long time when he had not a large quantity of wine at hand; his mind became feeble and confused, his gait was staggering and the tremor in his hands, lips and tongue increased. A few days ago he left the house in the morning and did not come back. I was told that after having drunk many small glasses of brandy he fell headlong in the street and was taken to hospital where he died a few hours later." And it was said that at autopsy of this wretched husband, who suffocated during his meal, the characteristic degenerations were found in the two commissures of the brain.

With regard to the relation between the anatomical alterations of the brain, especially the commissural, and the clinical symptoms, we will only state that, while experimental physiology can throw very scanty light on the functions of the two great commissures—especially of the corpus callosum—clinical experience and pathology show that such alterations as tumours, hæmorrhages, and circumscribed softenings confined to the corpus callosum, are accompanied by psychical disorders ("mental callosal symptom" of Raymond), which, in a morbid process of slow course, like a tumour, precede, as a rule, other symptoms, and, on the whole, may simulate dementia paralytica (Bristowe, Raymond, Schuster, Schupfer, etc., cit. by W. Gowers,[1] Levi Valenzi,[2] R. Oppenheim,[3] G. Mingazzini,[4] etc.). It is not, therefore, a daring conjecture to refer at least a part of the mental disorders observed in chronic drinkers to the degeneration of the great commissures, especially the corpus callosum, a path connecting cortical centres for whose normal function the association seems to be of great significance.

If to the degeneration of the commissures we add, in some cases, the alterations of like nature in the median peduncles of the cerebellum, through which

1 "Diseases of the Nervous System," ii, London, 1888.

2 "Le corps calleux," Paris, 1910.

3 "Lehrbuch der Nervenkrankheiten," Berlin, 1913.

4 "Anatomia clinica dei centri nervosi," Torino, 1912; "Der Balken," Berlin, 1922.

the frontal lobe of one hemisphere of the brain is connected with the opposite cerebellar hemisphere, and the degeneration of more or less extensive areas of the white substance of both hemispheres, across which pass tracts of fibres of various anatomical and functional significance, it is evident how deleterious and destructive the toxic action of alcohol may be on the human brain; and it recalls the tragic reality that Shakespeare expresses in the words of Cassio,[1] "O God, that men should put an enemy into their mouths to steal away their brains."

[1] *Othello*, Act II, Sc. iii.

Section of Obstetrics and Gynæcology.

President—J. P. HEDLEY, M.Ch.

[*March* 17, 1933.]

A Case of Concealed Accidental Hæmorrhage associated with Spontaneous Complete Rupture of the Uterus.

By G. F. GIBBERD, M.S.

Mrs. M. P., aged 39, had had nine previous pregnancies. Of these, eight had resulted in living children delivered without difficulty. One pregnancy—the eighth—terminated prematurely at the twenty-eighth week with antepartum hæmorrhage and a stillborn fœtus.

Her last pregnancy—the tenth—was complicated at the twenty-second week by an attack of *B. coli* pyelitis, but she became symptom-free after treatment for a week in hospital. She was seen at the twenty-fifth week at the antenatal department, when she complained of no abnormal symptoms, her urine was free from albumin, and there was no rise in blood-pressure.

She was admitted to the hospital at the twenty-eighth week on account of antepartum hæmorrhage amounting to about half a pint. On admission there was slight bleeding. The cervix was dilated sufficiently to admit one finger and membranes could be felt covering the os internum. The fœtus presenting by the vertex was felt, and the fœtal heart was heard. A diagnosis of revealed accidental hæmorrhage was made, and morphia, gr. $\frac{1}{4}$, was given.

Three hours later, the patient began to complain of continuous abdominal pain. The uterus soon became board-like in consistency and appeared to be increasing in size. The fœtal parts could not be made out, nor was the fœtal heart audible. A catheter specimen of urine contained albumin ($\frac{1}{2}$ per 1,000). The blood-pressure was 130/80. There was no œdema. A diagnosis of concealed accidental hæmorrhage was made.

As her general condition was good, and as the loss of blood per vaginam was slight, it was decided to treat her upon conservative lines. Morphia, gr. $\frac{1}{6}$, was given. Three hours later she was still complaining of severe continuous abdominal pain. The uterus was still very tense and had obviously increased in size. The general condition was still good. A further injection of morphia, gr. $\frac{1}{4}$, was given. After this she became more restful, but an hour later she suddenly collapsed, became very pale, and pulseless. This was accompanied by a sudden flow of blood per vaginam, and on abdominal palpation it became obvious that the uterus had ruptured and that the fœtus had escaped into the peritoneal cavity.

Laparotomy was performed. The fœtus, together with its placenta and membranes, was removed from the peritoneal cavity with a large quantity of blood and clot. The ruptured uterus was removed by sub-total hysterectomy. Gum-saline and a blood-transfusion were given, but the patient died about an hour after the operation.

The Specimen.

The specimen shows the body of the uterus as removed at operation.

There is a transverse rupture in the fundus extending from just in front of the right Fallopian tube, to just behind the left tube. The uterus, as preserved, is in the state in which it was found at operation—i.e., almost completely retracted, the small space in the cavity having been occupied by blood-clot. That part of the anterior wall which is in the region of the rupture is very thin (less than $\frac{1}{8}$ in. in the retracted state), and this contrasts strikingly with other parts of the uterine wall which are of normal thickness. A small wedge of the complete thickness of the wall has been removed in this thin region, and on microscopical

examination it shows no gross cytological abnormality, apart from early hyaline change in a few fasciculi of muscle. The striking feature is a very great deficiency of tissue with perhaps a slight relative excess of fibrous elements.

I have reported this case because I have been unable to find any similar account of complete rupture of the uterus in concealed accidental hæmorrhage. Partial ruptures are well recognized, but as far as I am aware in the cases hitherto recorded the ruptures have for the most part been small fissures involving the peritoneal and most superficial part of the muscular coats only. In 1916 McNair [1] described a case of concealed accidental hæmorrhage in which there were multiple fissures on the peritoneal surface of the uterus resulting in a large intraperitoneal hæmorrhage. In his case there was a deep fissure on the inside of the uterus running across the placental site, but this did not involve the whole thickness of the uterine wall. McNair referred to similar cases in which small peritoneal fissures had been described by Fraipont, Shannon, Clifford, and Fletcher Shaw. Phaneuf [2], in 1919, described two cases in which larger ruptures—2 in. in length—were found involving the muscular and peritoneal layers, but not opening into the uterine cavity.

I have been unable to find any report of a case in which a complete rupture of the type shown here has occurred in a case of concealed accidental hæmorrhage.

That the sudden and increasing distension of the uterus by blood was, in fact, the exciting cause of rupture in this case, cannot be doubted from the clinical course. There can also be little doubt that the predisposing cause in this case was the very thin uterine wall, and from the absence of any gross disease in this thin part we must look upon it as a localized failure to hypertrophy on the part of the uterine muscle.

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[2] Phaneuf, L. E., *Surg. Gyn. and Obst.*, 1919, xxix, 575.

A Case of Concealed Accidental Hæmorrhage associated with Spontaneous Complete Rupture of the Uterus.

By C. M. Gwillim, F.R.C.S.

The specimen shown is from a case of concealed accidental hæmorrhage, associated with spontaneous complete rupture of the uterus. There is a tear, extending from the cervix to the fundus, along the left side of the uterus. The peritoneal coat, muscle and decidua all show interstitial hæmorrhages, but the thickness of the uterine wall is uniform and normal. Histologically the muscle fibres appear to be normal. The case history is as follows:—The patient was aged 22 years and had previously had one normal pregnancy and labour. She was thirty-seven weeks pregnant.

At 6.30 p.m. on March 28, 1929, she was seen, on the district, complaining of continuous abdominal pain and vaginal bleeding. She was blanched, and her pulse-rate was 110. The uterus was hard, wooden, and tender. No contractions were felt. The fœtal parts could not be felt, and the fœtal heart sounds were not heard. The flanks were resonant. A binder was applied and the patient was sent in to the General Lying-in Hospital, York Road.

At 1 a.m. the cervix was fully dilated and the membranes were ruptured artificially. The head was well down.

At 1.30 a.m. the patient suddenly had an acute pain and became blanched and restless. The pulse-rate was 148. She had no more pain after this. The fœtal parts were easily felt and the flanks were dull. The uterus could be felt in the right iliac fossa, and on vaginal examination the rent could be felt.

On laparotomy the placenta and child were found in the left hypochondrium. The abdomen was full of blood and clot.

A total hysterectomy was performed. Intravenous saline and blood-transfusion were given. The patient made an uninterrupted recovery.

Puerperal Fever.—A Report upon 533 Cases received at the Isolation Block of Queen Charlotte's Hospital.

By L. C. Rivett, M.Ch., Leslie Williams, M.S., Leonard Colebrook, M.B., and R. M. Fry, L.R.C.P., M.R.C.S.

On behalf of the Clinical and Laboratory Staff of the Hospital.

We are so much impressed with the necessity for full bacteriological investigation that we definitely state that every case of pyrexia in the puerperium must have full laboratory investigation before adequate treatment can be given. Queen Charlotte's Isolation Block for the reception, investigation and treatment of cases of puerperal sepsis was opened in September, 1930, and the laboratory was opened in February, 1931. Its objects are twofold. Firstly, to provide accommodation for cases of puerperal fever in patients of all social grades (we have private wards and semi-private wards, as well as wards for hospital patients). Secondly, to conduct research into the causes and treatment of puerperal sepsis.

This report deals with 533 cases admitted during the period September, 1930, to December, 1932, and the table shows the sources from which cases were sent.

Table I.—Source of the 533 Cases (with mortality-rates).

		Cases	Deaths	Mortality
From Q.C.H.	Booked. In-patients	97	3	3·1%
	Booked. Out-patients	80	3	3·75%
	Emergency. In-patients	36	7	19·4%
	From other hospitals, private doctors, Medical Officers of Health	320	61	19%

The large number sent from Queen Charlotte's Hospital is due to the fact that all cases of pyrexia (except trivial rises of temperature, obviously due to some minor non-puerperal cause) are transferred immediately to the Isolation Block.

It is interesting to analyse still further the Queen Charlotte's Hospital cases.

During the period under review 5,802 cases were delivered at the main hospital and annexe at Goldhawk Road, and of these 408 were emergency cases sent in by doctors. 4,129 cases were delivered in their own homes on the Queen Charlotte's Hospital district; all district cases received antenatal supervision.

The value of early admission and antenatal care is well brought out in the following table.

Table II.—Death-rate from Sepsis. Total Q.C.H. Deliveries, Sept., 1930 to Dec., 1932.

		Deaths from sepsis	Mortality-rate from sepsis per 1,000 deliveries
Booked cases. In-patients	5,394	4	0·74
Booked cases. Out-patients	4,129	3	0·72
Emergency cases. In-patients	408	6	14·7
Total	9,931	13	1·3

Further, of the total 133 in-patients transferred to the Isolation Block, only 33 (24·8) were found to be infected with hæmolytic streptococcus, whereas of the 80 district cases there were 43 (53·7). This is not in accord with the generally accepted view that the incidence of potentially serious infection is greater among cases delivered in hospitals than among those delivered in their own homes.

Taking into account one other case, not shown in the above table, in which the patient died from peritonitis twenty hours after Cæsarean section, the mortality from sepsis for all Q.C.H. cases (in-patient and out-patient) was 1·3% per 1,000 deliveries, whereas the average for England and Wales is about 2 per 1,000 live births.

This low death rate—for an institution which admits a large number of emergency cases—is undoubtedly due to the early admission and treatment of febrile cases at Q.C.H. This factor is especially brought out by comparison with the death-rate of cases admitted from other sources.

Factors bearing upon the Ætiology of the Infections.

An attempt to analyse the factors bearing on ætiology brings out a few interesting points, which are, on the whole, negative.

289 cases admitted with a history of a *normal spontaneous delivery*, in many cases with no vaginal examinations at all, have been analysed. Included among

Table III.

	No. of cases	Deaths
Normal spontaneous delivery	252 ...	28=11·1%
Abortion	37 ...	5=13·5%

normal deliveries there were 37 cases of pyrexia following abortions, and five of these died, a mortality of 13·5%. Of the 252 cases of spontaneous labour at term 28 died, a mortality of 11·1%. Nearly 50% of the cases admitted were following normal delivery, so it is clear that serious sepsis does follow normal labour. Further, of all the fatal cases only 28 are recorded as having perineal or vaginal lacerations. These facts emphasize that some factors other than repeated examinations and lacerations of the genital tract must be sought for as the explanation of a large number of these infections. The possibility of "droplet infection" during delivery, or shortly afterwards, is being investigated.

Parity appeared to have a marked bearing on ætiology. Three-fifths of the cases were primiparæ, and the following table shows how the incidence falls as the number of children increase:—

Table IV.

Parity	1	2	3	4	5	6	7	8 and over
No. of cases	312	96	45	26	16	16	9	12

80% of the admissions occurred after the first two confinements, so that, even allowing for the modern tendency to small families, the first two confinements are the most dangerous.

Ill-health during pregnancy was noted in about one-third of the cases. In many cases this was quite vague, and is covered by the terms "debility" and "malnutrition." Albuminuria had been present in 47 cases, and definite septic foci in 18. Taking into account the general incidence of these two conditions, the evidence that they have any influence on puerperal sepsis is very striking.

Intra-uterine manipulations are recorded in 202 cases. These manipulations include forceps, embryotomy, extended breech, internal version, rotation and Cæsarean section. There were in addition 44 cases of manual removal of the placenta, with six deaths. Taking these cases together, they are just below 50% of the admissions, and the death rate is just below the average for the whole series.

It is probable that internal manipulation is an important factor in the production of serious sepsis, but it is not evident in this series, though its importance in the production of infection by anaerobic streptococci is referred to in the section on Bacteriological Classification.

Lacerations were noted in two-thirds of the cases admitted (334), and in 28 of the fatal cases, so that the mortality of cases in which lacerations are recorded is 8·4%. Many of these lacerations were slight, and many were perineal only. It is our impression that high vaginal and cervical lacerations are particularly serious.

Hæmorrhage.—Ante-partum occurred in 28 cases (5·2%) and post-partum hæmorrhage was recorded in 95 cases (18%). Only a few cases have been admitted which showed clinical signs of loss of blood.

The data concerning age, ante-partum vaginal discharge and protracted labour yield no useful information.

Clinical Classification.

In classifying the cases under our care we have regarded all cases of puerperal sepsis as examples of wound infection by pathogenic organisms, usually of the pyogenic group and principally of the group of hæmolytic streptococci.

We feel that the old term "sapræmia" should be abandoned as completely misleading and as a totally wrong interpretation of the pathological findings. In saying this, we do not overlook the dramatic recovery that occurs in cases of septic incomplete miscarriage when the stinking piece of retained placenta is removed. On the contrary, we regard the improvement as evidence of the value of drainage. For when the loose piece of placenta is pulled away from the region of the cervix, good drainage is established and the anti-bacterial activity of the uterine lymph is enabled to deal with the remaining infection in all but the most severe cases.

In the classification we have employed, the word "sapræmia" does not occur. Instead we regard the uterus, in most cases, as the site of a primary local infection by one or more types of pathogenic organisms, and should the infection spread beyond the uterus, then we recognize one or more of the possible lines of extension. It will, of course, be recognized that in certain cases a deep vaginal tear, or even a lacerated perineum, may be the site of the primary infection, but in the majority of cases it is the area in the uterus from which the placenta has been separated which bears the initial attack of the invading organisms.

It is thus found convenient to regard all cases of puerperal pyrexia as coming under one of the following headings:—

(1) Local wound sepsis—uterine usually, but sometimes vaginal or perineal.
(2) Local sepsis plus spread to the blood-stream (septicæmia).
(3) Local sepsis plus spread to the general peritoneum (peritonitis).
(4) Local sepsis plus spread to the Fallopian tubes, ovaries, pelvic cellular tissue and peritoneum.
(5) Local sepsis plus spread to the veins (thrombophlebitis).
(6) Extra-uterine infections closely connected with the puerperal state: (i) *B. coli* urinary infection; (ii) mastitis.
(7) Pyrexial conditions not directly connected with the labour: The acute fevers, tuberculosis, etc.

The following routine examinations have been carried out in this series of 533 cases:—

(*a*) Abdominal examination; (*b*) Examination of the perineum, vagina, cervix uteri, etc.; (*c*) Examination of the breasts, legs, chest, etc.; (*d*) Bacteriological examination of material from the cervix uteri (or in cases with much laceration, from the vagina); (*e*) Blood culture; (*f*) Bacteriological and chemical examination of the urine.

As a result of all these examinations, together with a consideration of the general condition of the patient, the 533 cases have been classified as follows:—

(1) *Cases of Local Wound Sepsis, i.e., of the Uterus, Vagina or Perineum.*

There were 308 cases in the group—with no deaths. This experience agrees with that obtained at other clinics. When the infection remains localized the danger is extremely small.

(2) *Cases of Local Sepsis plus Spread to the Blood-stream, i.e., Septicæmia.*

(In the recognition of septicæmia it has proved essential that the blood taken for culture should be cultivated anaerobically as well as aerobically, and that suitable media be employed for the growth of anaerobic streptococci (*vide* Bacteriological Classification *infra*). With these precautions we can be fairly certain that a series of negative results means that there is no invasion of the blood-stream.

Conversely, a positive blood culture gives definite evidence of the presence of an infection of the blood-stream and of the nature of the infecting organism.

Among our 523 cases there were 81 in which genital sepsis was associated with infection of the blood-stream. The details of these infections are shown in the following table:—

TABLE V.—BACTERIOLOGY OF THE 81 CASES GIVING POSITIVE BLOOD-CULTURES.

	Strep. pyog.	Anaer. strep.	B. coli	Staphylococcus	Other organisms
Cases ...	49	19	6	2	5
Deaths ...	43	8	1	2	1
Mortality ...	87·8%	42·2%	16·6%	100%	20%

Total mortality rate 68%.

The total mortality among the group of 81 cases with positive blood-culture was thus 68%. In other words 32% of cases of proved septicæmia recovered, the highest rates of recovery being among those with a blood infection by anaerobic streptococci or *B. coli*.

We have had no cases of that fulminating type of streptococcal septicæmia which ends fatally within twenty-four or forty-eight hours without general peritonitis. Our experience does not support the old conception of septicæmia as a condition in which streptococci multiply rapidly in the circulating blood. Samples of blood taken from day to day show that there is usually no great increase in the number of living cocci until the last few hours of life. Table VI gives the blood-culture counts of three illustrative cases.

TABLE VI.—THE NUMBER OF STREPTOCOCCI IN THE BLOOD IN SEPTICÆMIA.

Mrs. H.—Recovered.	Mrs. G.—Endocarditis.	Mrs. M.
March 24, 80 per c.c.	March 18, 124 per c.c.	March 30, 8 per c.c.
,, 25, 82 ,,	,, 19, 10 ,,	,, 31, 14 ,,
,, 27, 5 ,,	,, 21, 17 ,,	April 1, 0 ,,
,, 29, 34 ,,	,, 23, 0 ,,	,, 3, 0 ,,
,, 30, 0 ,,	,, 24, 15 ,,	,, 6, 0 ,,
April 1, 3 ,,	,, 25, 8 ,,	,, 7, 0 ,,
,, 3, 1 ,,	,, 26, 1 ,,	,, 14, 1,600 ,,
,, 6, 9 ,,	,, 28, 1 ,,	,, 15, 250 ,,
,, 8, 1 ,,	,, 30, 68 ,,	,, 16, 330 ,,
,, 20, 1 ,,	,, 31, 136 ,,	,, 17, 141 ,,
,, 24, 12 ,,	April 3, 530 ,,	,, 18, 127 ,,
,, 26 - 0 ,,	,, 4, died	,, 19, 127 ,,
,, 28, 30 ,,		,, 22, died.
,, 30, 0 ,,		

Post-mortem findings have shown us that in 90% of the septicæmic cases there is a gross focus of infection from which the blood-stream had, almost certainly, been invaded (Table VII). It is probable that in the remaining 10% of cases a focus was present, perhaps in one of the pelvic venous plexuses.

TABLE VII.—PUERPERAL SEPTICÆMIA. (POSITIVE BLOOD-CULTURES.)

81 Cases. 55 Deaths. Mortality 68%.

Fatal Cases.	
Assoc. with Peritonitis	32
,, ,, Thrombophlebitis (large veins) ...	10
,, ,, Endocarditis	5
,, ,, Pneumonia	2
No gross focus of infection found	4
No P.M.	2
Recovered Cases.	
(Focus of infection undetected)	26

(*Str. viridans* was also isolated from the blood of two patients; one, a patient who subsequently had a blood infection by anaerobic streptococci; the other, a patient who had *Str. pyogenes* in the blood.)

In two cases both hæmolytic and anaerobic streptococci were present in the blood. These are not included under the group of blood infection by anaerobic streptococci.

Of the nine cases with anaerobic streptococci present in the blood, seven were multiple infections, i.e., their blood cultures grew either two different types of anaerobic streptococci (three cases), or anaerobic streptococci plus one or more other bacterial types, e.g., *Str. viridans* (one case), and unidentified anaerobic Gram-negative bacillus (two cases).

(3) *Cases of Local Sepsis plus Spread to the Peritoneum (Peritonitis).*

In the period under discussion we have had 53 cases of general peritonitis complicating genital sepsis, i.e., 10% of the admissions. Of these 53, only eight have survived.

Certain features of this disastrous group of cases are worthy of detailed study.

(*a*) Parity.—The great majority of our cases occurred after the first or second confinement. Among the 45 fatal cases, the incidence, according to parity, is shown in the accompanying table:—

TABLE VIII.

Parity	1	2	3	4	5	6	7	8
No. of Cases ...	26	17	3	1	2	1	1	1

(*b*) Associated septicæmia.—Blood infection was associated with peritonitis in 32 of the 45 fatal cases. In 28 cases the blood contained hæmolytic streptococci, in one case staphylococci, in one *Str. viridans*, in one *B. coli*, and in one anaerobic streptococci and *B. proteus*.

In the 16 blood-negative cases an abundant culture of hæmolytic streptococci was obtained from the cervix.

(*c*) Associated thrombophlebitis.—Of the 45 fatal cases of peritonitis, 11 showed ante-mortem thrombosis of one ovarian vein, two had thrombosed veins in the legs, one had both ovarian veins and the left common iliac vein thrombosed, and one showed thrombosed veins in the broad ligament.

In 30 cases there was no evidence of venous thrombosis, even on careful post-mortem examination.

(*d*) Lacerations.—Lacerations were noted in 34 of the cases. Thirteen of these were sutured, four were not sutured, and in the rest there is no record.

(*e*) Type of labour, followed by peritonitis.—This will be appreciated from the following table. The large number of normal labours and of normal B.B.A. cases is striking.

TABLE IX.

B.B.A.	N.L.	Forceps	Cæsarean Section	Craniotomy
3 ...	25 ...	12 ...	1 ...	2

The remaining 8 cases were: long labour 1, miscarriage 4, face presentation, failed —rotation and version to breech 1, and breech 2.

Peritonitis.—During the period ending December 31, 1931, there were 31 cases of general peritonitis. That is 11% of the admissions. Only one survived and that case was drained early. The blood was infected in 22 of the fatal cases. In two cases the peritoneal infection was only detected at post-mortem examination.

Diagnosis of peritonitis.—It cannot be too strongly emphasized that the classical signs of peritonitis are absent in these cases, and that the diagnosis of peritonitis must be made on very slender evidence if laparotomy is to be done sufficiently early to be of benefit to the patient. Of the 31 cases of peritonitis, only one recovered and in this one case laparotomy was performed early. Laparotomy was performed in 13 other cases, all of which ended fatally. In our earlier series we delayed

surgical interference until we were really sure that there were clinical grounds for a definite diagnosis of peritonitis. We desire to make it clear that there is a mistaken policy which we have now changed. When a patient is suspected of peritonitis, we make a small abdominal opening (under local anæsthesia, if necessary). If streptococci or pus cells can be demonstrated on immediate microscopic examination of a smear, then the peritoneal cavity is drained.

On reviewing the clinical symptoms and signs which were present in the series of cases, we came to the conclusion that there was no clinical syndrome which could be stated as being diagnostic of general peritonitis. Rigidity was hardly ever present, and constipation very rarely. The tongue was usually coated and dry, and the temperature and pulse-rate raised. The following table will show how few of these cases give any complete picture of peritonitis, particularly when it is remembered that these were all the symptoms exhibited among the 30 fatal cases.

TABLE X.

Tympanites	22
Tenderness	13
Pain (with or without tenderness) ...	9
Rigidity	4
Diarrhœa	4
Vomiting	5
Free fluid (clinical examination)	2

In two cases there was absolutely no suspicion of general peritonitis until the post-mortem examination.

In two cases there was absolutely no suspicion of general peritonitis until the post-mortem examination, in spite of repeated abdominal examinations. We came to the conclusion that if any two of these symptoms or signs were present, we would open the abdomen and immediately examine the peritoneal exudate microscopically, and, if pus cells were present, drain. During 1932 we have followed this policy, and 18 cases of peritonitis have been operated upon. In most cases the operation has been performed very shortly after admission, without waiting for the result of a blood-culture. In three cases the diagnosis was made in the post-mortem room and in the one other case the blood-culture was positive and the patient jaundiced, and although peritonitis was suspected no operation was done.

TABLE XI.—PERITONITIS—THE EFFECT OF DRAINAGE.

First series. 31 cases		Deaths	Mortality rate
14 drained—often late		13 ...	93%
17 undrained		17 ...	100%
Second series. 22 cases			
18 drained—often early ...		11 ...	61%
4 undrained		4 ...	100%

TABLE XII.

Organism in peritoneum	Blood-culture		Operation		Result	
	Pos.	Neg.	Yes	No	R.	D.
Hæm. strep.	9		6	3		9
Hæm. strep.		8	8		4	4
Non-hæm. strep.		3	3		3	
Non-hæm. strep.		1		1		1
Strep. viridans	1		1			1

TABLE XIII.—BACTERIOLOGY OF 31 CASES OF PUERPERAL PERITONITIS.

Cases infected with *Str. pyogenes*		23
Peritoneum found infected at P.M.	5	
,, ,, ,, during life	18	
,, ,, ,, at time of operation	11	
,, ,, ,, 24 hours later	3	
(One a mixed culture)		
,, ,, ,, 48 hours later	1	
,, ,, ,, 72 ,, ,, ...	1	
Cases infected with other organisms		8

Anaerobic strep. (2). *S. fæcalis* and indiff. (1 each). Staphylococci (1). *B. welchii* (1). *B. proteus* (1). Mixed (1).

(4) *Cases of Local Sepsis plus Spread to the Fallopian Tubes, Ovaries, Pelvic Cellular Tissue and Peritoneum.*

Sixty-two cases were considered to belong to this class. 14 died, giving a mortality of 22·5%. In two cases a parametritic abscess tracked into the cave of Retzius.

(5) *Cases of Local Sepsis plus Spread to the Veins (Thrombophlebitis).*

There were 56 cases exhibiting spread by infective thrombophlebitis. Among these 56 cases there were 41 deaths—a case mortality of 73·5%.

The thrombophlebitis was not always diagnosed before death. Many cases were only discovered at autopsy, but others were found at laparotomy performed on a diagnosis of probable thrombophlebitis. Some cases are included because there was obvious thrombosis in the main veins of the legs.

The distribution of the thrombosis in the 56 cases here reported was: pelvic veins, 19 cases; other veins, 37 cases.

It is a remarkable fact that we have only had two cases of persistent "white leg" among the whole of our 533 admissions, although we have had many cases of thrombosed veins in the legs. We attribute this to treatment by elevation of the limb, and to the intermittent administration of large doses of citric acid. Furthermore, there has been only one case of death from pulmonary embolus, and she had no sign of thrombosis either when alive or post mortem.

With regard to this subject of infective thrombophlebitis we wish to make certain general observations. Correlation of the clinical features and post-mortem findings in our fatal cases has abundantly confirmed the view that streptococci are very frequently liberated into the blood-stream from one or more of the occluded venous efferents of the uterus when these are filled with disintegrating infected clot. In general surgery there is, of course, the well-known analogous condition of spreading thrombosis from an infected lateral sinus extending down the jugular vein. And it is clear that many such cases are saved by the division or excision of the thrombosed vein after ligation below the clot. But the condition in puerperal sepsis is more complicated, firstly, because of the difficulty of diagnosis, and secondly, because of problems of technique. These two points need further discussion.

Diagnosis.—The condition is not very common in cases of hæmolytic streptococcal infection. Even in the 45 fatal cases with general peritonitis, there was no apparent venous thrombosis in two-thirds of the cases.

But it does appear to be more common in cases of blood-infection with anaerobic streptococci. In fact the diagnosis spreading thrombophlebitis with detachment of infected fragments of clot must largely be based upon the occurrence of frequent rigors in a case with anaerobic streptococci in the blood. If the patient has two types of anaerobic streptococci in the blood, or an anaerobic streptococcus plus some other organism, such as *Str. fæcalis*, the picture is still more suggestive. It has been claimed, particularly by certain American writers, that the thrombosed veins can be palpated on pelvic examination. This is not the case in our experience. In fact the difficulty of finding the thrombosed veins at abdominal section, or even on post-mortem examination, renders it extremely unlikely that there is any truth at all in the claim. If, however, an ovarian vein is thrombosed, it is sometimes possible to elicit tenderness along its course, and should there be much perivascular œdema it may be just possible to palpate this on abdominal examination. It will therefore be appreciated that the diagnosis of spreading thrombophlebitis is an extremely difficult one. Nevertheless, we have ventured to make a diagnosis in certain cases and consequently to open the abdomen in the attempt to prevent the repeated infection of the blood-stream by some surgical procedure.

Technique.—In the effort to limit the spread of infection from an infected uterus, it would appear probable, at the first glance, that hysterectomy would be most

likely to succeed. But, in fact, this operation has been attended by such universally disastrous results not only in our hands but also in other clinics in France, Germany, America, etc., that it is no longer given serious consideration. Hysterectomy, then, being out of the question, the subject of ligation of veins now occupies most attention. The relatively simple operation required for a thrombosed jugular vein in cases of mastoid disease and the good results obtained thereby encourages perseverance in this direction. But the position is much more complicated when there is spreading thrombophlebitis from an infected uterus. In the first place it may be necessary to carry the dissection a considerable distance up the ovarian vein so as to get above the clot. Secondly, this may be insufficient since there may be thrombosis in the other ovarian vein, or thrombosis may develop there at some subsequent period. Therefore, it will probably be advisable in cases of ovarian vein thrombosis on one side, to ligate the opposite vein also. Thirdly, to eliminate danger of clot infection from any possible venous efferents from the uterus it may be deemed advisable to ligature the internal iliac veins on either side. And it should be remembered that there are often two trunks on one or both sides, and in any case a difficult dissection too involved. Fourthly, the laparotomy wound nearly always suppurates. It will be admitted then that the operation is difficult, and, if an attempt is made to block all the venous channels it is tedious, and, owing to its length, dangerous. So far we have made no attempt to perform the complete ligature operation, but it is being given serious consideration. In the cases which have been undertaken, we have ligatured only those veins in which a thrombosis could be discovered. Or, in the case of thrombosed internal iliac veins impossible of access, the common iliac vein has been tied. There have been too few cases to merit a detailed analysis of the results, but by occasional successes in cases which had, prior to operation, seemed quite hopeless, we feel justified in continuing to treat by abdominal section and vein ligature certain cases in which the diagnosis of spreading thrombophlebitis seems probable.

Urinary tract infections.—There were 146 cases of this kind. Ninety-five of them were infections by *B. coli* alone; 22 by *B. coli* plus other organisms; and 29 by other organisms (staphylococci, hæmolytic and non-hæmolytic streptococci, *B. proteus*).

In six of the *B. coli* cases there was an associated blood-stream infection by that organism and in one case by hæmolytic streptococci (endocarditis).

During the last six months of 1932, 24 cases of urinary tract infection were treated by a ketogenic diet. The urine became sterile within two to three weeks in 11 cases. On account of insufficient restriction of the carbohydrate intake we failed to obtain a definite ketonuria in 13 cases and in none of these was the number of *B. coli* in the urine greatly diminished.

(*b*) *Mastitis.*—This occurred in 20 cases and in 11 of them abscesses formed. Nineteen of them appeared to be pure infections by staphylococcus; in the one case cultures showed both staphylococci and hæmolytic streptococci.

Cases complicated by Thoracic Lesions.

Seventeen cases showed signs of septic pneumonia; 30 cases developed pleural effusion, eight pericarditis, five endocarditis, and three miliary tuberculosis.

There have been too few cases to justify a full account of the thoracic complications, but the following preliminary observations may be made.

Pulmonary and pleural lesions.—(The following account has been kindly written by Dr. T. C. Hunt, Physician to Queen Charlotte's Hospital.)

(*a*) In the more severe cases infected by hæmolytic streptococci, pleurisy with effusion has been the most common thoracic lesion. Of the 30 cases in which this was recognized, during life or post-mortem 14 recovered and 16 died. In 7 of the fatal cases the involvement of the pleura appeared to be secondary to a generalized peritonitis. The lungs of several of the fatal cases showed septic pneumonia in

greater or less degree. In others there was only some congestion and œdema. Several of the cases of pleural effusion which recovered and others in which no effusion was detected, showed clinical signs and symptoms of localized broncho-pneumonia, chiefly affecting the lower lobes.

(*b*) The clinical signs and symptoms of pulmonary involvement have often been slight, an increased respiratory rate, with a slightly impaired percussion note, and some fine or medium rales, being the only indications. There has seldom been severe pleural pain or cough. Sputum has been scanty, and only twice has been blood-stained.

(*c*) The pleural effusions may be sterile at first even in septicæmic cases, but usually become infected. When this has occurred it has been satisfactorily treated by repeated aspiration—open operation has only been resorted to when there was thick pus.

(*d*) Prognosis.—This has usually been very grave when the thoracic involvement was associated with peritonitis, but in the cases of pleural effusion without evidence of pneumonia the outlook has been more favourable.

(*e*) The few septicæmic cases infected by organisms other than hæmolytic streptococci which have come to autopsy have shown lesions somewhat different from the above, viz., one or several lung abscesses, presumably embolic in origin without pleural effusion.

(*f*) *Lesions of the heart and pericardium.*—The heart muscle has appeared to be but little affected by most of these infections, even after prolonged fever, and has clinically shown little enlargement, but exceptional cases have shown tachycardia, arrythmia, and a systolic murmur for a few days. Acute endocarditis (hæmolytic streptococcal infection) occurred in five cases.

Pericardial effusion was found post mortem in eight cases and occurred also in one patient who recovered. Aspiration has not been performed.

Source of the Infections.

Very few of the cases have occurred in circumstances which suggested epidemic spread of the infection. Nearly all were sporadic cases.

We have attempted to trace the source of infection in some 40 cases infected by hæmolytic streptococci. To that end swabs were taken from the patient's own throat and gums within two days of admission, and also from the throat and nose of nurses, doctors, and any other persons in contact with her during delivery. If hæmolytic streptococci were recovered from any of these swabs they were investigated by the most refined serological methods in order to determine whether or no they were identical with the strain isolated from the mother's genital tract or blood.

Not infrequently all the "contact swabs" and those from the patient's own throat and nose were "negative," and the investigation came to an end; in other cases the patient's own throat or nose harboured hæmolytic streptococci identical with that of her uterine infection, and even if these streptococci were also present in the throat of a contact, it was not possible to decide whence the infection had arisen.

Mrs. X. was a case of this kind. She engaged a nurse for her confinement who, as it transpired subsequently, had had two attacks of tonsillitis within the previous six weeks. She had another three days after the mother's delivery. The streptococcus recovered from the nurse was identical with that from the mother's peritoneal exudate, and in all probability was responsible for the infection, but we could not be quite certain because the same streptococcus was also cultivated from the mother's throat on admission. Had we had a swab from the mother's throat and genital tract at the time of her labour and found them negative, the evidence would have been practically complete.

In the hope of collecting such complete evidence in the future we have recently instituted as a routine the examination of swabs from throat, nose, gums, and vagina of most of the cases on the Queen Charlotte's Hospital District at the time of labour.

Bacteriological Classification of the 533 Patients.

Immediately on admission a swab was taken from the cervix uteri, or, if there was very severe laceration, from the vagina. Films and cultures on horse-blood agar were made from these swabs, the latter being incubated both aerobically and anaerobically (Mcintosh and Fildes jar). Swabs have not been taken from the body of the uterus since there appears to be no advantage in doing so in the great majority of cases.

If we wished to know as quickly as possible whether a particular case was infected by hæmolytic streptococci the swab was incubated in a tube of nutrient broth, to which a drop or two of sterile blood had been added, and the fluid kept in constant motion by means of a Ridley hydro-dynamic mixing machine (*Brit. Journal Ex. Path.*, 1928, ix, 253). After incubation for five or six hours, the presence of hæmolytic streptococci was revealed by commencing hæmolysis of the blood-corpuscles and the finding of many streptococci in a film of the broth.

Blood-cultures.—From all cases having fever above 101°, one or more 4-c.c. samples of blood were taken. The blood was distributed as follows for the cultivation of the various types of pathogenic organisms:—

(*a*) One c.c. was mixed with melted agar (at 47° C.) in a Petri dish and incubated aerobically in order to give a rough idea of the number of organisms in the blood.

(*b*) One c.c. was inoculated into 7 or 8 c.c. of glucose broth, with which about 0·5 c.c. of sterile trypsin (Fairchild) has been thoroughly mixed.

(*c*) One c.c. was inoculated into a tube of minced-meat medium plus broth, made as described by Lepper and Martin (*Brit. Journal, Exp. Path.*, 1929, x, 327). This medium is covered with liquid paraffin, and is suitable for the growth of all kinds of anaerobic, as well as most of the aerobic, pathogenic bacteria.

(*d*) One c.c. was inoculated into a tube of medium which has proved in our hands the most suitable for the growth of the anaerobic streptococci. It consists of a tryptic digest of minced liver with a pH. of 6·8 to 7·0, and is covered with a vaseline seal. (*Vide* Colebrook and Hare, *Journ. Obst. of Brit. Emp.*, June, 1933.)

We wish to stress the importance of using methods appropriate to the cultivation of anaerobic streptococci in the investigation of all cases of puerperal infection.

	Number of cases		Case mortality
Cases infected by *S. pyogenes* (hæmolytic). Total	208	...	26%
Culture from genital tract only	148		
,, ,, blood and genital tract	41	...	90%
,, ,, peritoneum and genital tract	23	...	70%
,, ,, genital tract, blood and peritoneum	28	...	100%

Comments.—(1) 39% of all the patients admitted were infected by hæmolytic streptococci.

(2) Included in these cases is one in which the streptococci (isolated from the blood and the uterus) belonged to the "pseudo-hæmolytic" variety described by Cumming (*Journ. Path. and Bact.*, 1927, xxx, 279). It gave good beta hæmolysis on the surface of horse-blood agar, but no soluble hæmolysin. So far as we are aware this is the only recorded instance of septicæmia due to this variety of streptococci. The patient (No. 232) recovered.

(3) The case mortality rate for these cases should not be taken to represent the average rate for this kind of infection. The inclusion of an unusually large

proportion of cases of peritonitis will have tended to make the rate too high, and the early admission of mild cases from the Queen Charlotte's Hospital district will have tended to make it too low. It is of interest to note that the mortality rate for the twenty-six cases admitted at an early stage from the district during 1930-31 was only 7·7%, while that for all cases admitted from other sources during the same period was 42%.

(4) In only one case was a hæmolytic streptococcus isolated from the blood when it was not present in the swab from the genital tract. The third cervical swab from this case grew a few hæmolytic streptococci, but these might conceivably have come from the blood-stream. Autopsy showed a recent endocarditis on the site of an old valve lesion.

Cases infected by (strictly) anaerobic streptococci.

	Number of cases	Case mortality
Culture from the genital tract and the blood ...	19 ...	42·2%
Abundant culture from the genital tract only ...	138 ...	0%

(Many more cases gave less abundant growths of anaerobic streptococci.)

Comments.—(1) It is impossible to give a reliable figure for the total number of infections by anaerobic streptococci. They are frequently present, both in the mild febrile cases and (less frequently) in those in which there is no fever or any definite sign of infection of the tissues. Probably in many of these cases they are merely saprophytic invaders of the placental site or of devitalized tissues elsewhere.

On the other hand these organisms have now been cultivated from the blood in no less than thirty-six cases of puerperal fever by the Queen Charlotte's Hospital staff in the last three years, and we believe it to be established beyond doubt that they are potentially pathogenic organisms—second only in importance to the *Streptococcus pyogenes*.

It is highly probable that for every case of generalized (septicæmia) infection—usually associated with thrombophlebitis—there are at least five cases of infection by these anaerobic cocci, which remain localized to the uterine pelvic cellular tissues. On that presumption there would have been approximately ninety-five such cases of localized infection by anaerobic streptococci in the series under review, and it will be seen that a rather greater number of cases actually did give an abundant culture from the genital tract.

We conclude, therefore, that the total number of cases so infected was probably about 25% of all the patients admitted.

In many cases two more or less distinct types of anaerobic streptococci were present together in the uterine cultures: and two other types were less frequently met with. The characteristics of these types have been recently described by Colebrook and Hare, *Journ. Obst. of Brit. Emp.*, June, 1933, xl, 609.

(2) In only three of the septicæmic cases has a hæmolytic streptococcus (*S. pyogenes* type) been isolated from the blood at the same time as the anaerobic variety. In one case the first blood-culture grew only the anaerobic streptococcus, although the hæmolytic one was present in the uterine swab. Subsequent blood-cultures yielded both varieties. The patient died.

Although, as stated, the anaerobic and hæmolytic types are seldom found together in the circulating blood, it frequently happens that two types of anaerobic streptococci are present together, or one type plus some other quite different species, e.g., *Str. viridans* or *fæcalis*.

(3) The most constant pathological condition associated with septicæmic infection by these streptococci was thrombophlebitis, spreading upwards in the veins draining the uterus and the vagina. Four cases developed general peritonitis.

(4) The history of the 19 anaerobic septicæmic cases has confirmed the opinion previously formed that these infections are particularly liable to follow difficult

exhausting labours involving internal manipulations. Not one of the first ten of these cases had a normal spontaneous delivery, as will be seen from the following summary.

Case No.	
15	Very long labour. Breech with extended legs.
79	Face presentation. Failed, forceps at home.
48	Bougie induction. Persistent occipito-posterior. Difficult, forceps. Severe hæmorrhage.
74	Bougie induction. Ante-partum hæmorrhage. Primary uterine inertia. Tonic contraction. Perforation.
121	Completely adherent placenta. Severe hæmorrhage and shock.
174	Manual removal of placenta following long labour. Hæmorrhage.
176	Primary uterine inertia. Perforation. Manual removal of placenta.
225	Breech presentation. Legs brought down.
233	Twins. Manual rotation and forceps for one.
272	Manual removal of adherent placenta.

Of the remaining nine cases four had an instrumental delivery, one a manual removal of the placenta, and four followed abortions, which were almost certainly self-induced in two cases.

(5) The cases have occurred sporadically—there being no circumstances which suggested epidemic spread.

Cases infected by B. coli.	No. of Cases
Abundant culture from the urine	113
" " " blood and the urine ...	6

Many of these cases included in the 113 which gave an abundant culture from the urine also had *B. coli* in the cultures made from the uterus. As in the case of the anaerobic streptococci, it was often very difficult to determine whether there was a definite infection of the uterine tissues by this organism and to what extent such infection was responsible for the fever.

The one fatal case of *B. coli* septicæmia was one which followed a protracted breech delivery with subsequent sloughing of the vaginal vault, and finally rupture into the peritoneum.

Septicæmic infections by organisms other than S. pycgenes, *anaerobic streptococcus and* B. coli.

	No. of cases	Case mortality
Cases infected by *Staphylococcus aureus*	2	100%
" " " an unidentified anaerobic bacillus	2	0%
" " " *Str. indifferens*	1	100%
" " " *B. paratyphosus*	1	0%
" " " an unidentified anaerobic bacillus (the "Fry-Cooper" bacillus)	2	0%
(This organism was also isolated from the blood of two more cases, in association with anaerobic and hæmolytic streptococci. It is a Gram-negative bacillus, rather variable in its morphology, which grows on ordinary nutrient agar. Although it will not grow in presence of oxygen, cultures when once grown are not readily killed by exposures to air.)		
Cases infected by a second type of unidentified anaerobic bacillus	1	0%

Post-mortem Findings.

During the period September 1930 to December 1931, post-mortem examinations were made on 33 cases in which the patients had died from puerperal sepsis. Of these, 27 cases were hæmolytic streptococcus infections, one was a mixed infection with hæmolytic and anaerobic streptococcus, and five were infections by other organisms.

Pure hæmolytic streptococcus infections.—Among the 27 cases in this group the most constant finding was generalized peritonitis, which was recorded in 20 cases.

One patient had an early pelvic peritonitis, which would have probably become generalized if she had lived longer, and in the remaining six cases the peritoneum was not infected.

In the cases with peritonitis, only eight showed a marked degree of abdominal distension. In most of these the distension was mainly confined to the large intestines. Four others showed a little distension, and in the remaining eight cases there was no distension whatever, in spite of an advanced general peritonitis.

The peritoneal effusion was usually a thin greenish fluid, with flakes of plastic lymph floating and adherent to the peritoneal surfaces. There was often some matting together of coils of intestine and omentum, but this was never sufficient to succeed in localizing the infection in any way. In fact, a characteristic of these cases was the very slight degree of hyperæmia of the peritoneum and the complete absence of any localization. Œdema of the sub-peritoneal tissue was only rarely observed.

Amongst the other important findings in these cases, the chief were thrombophlebitis, and abscesses of the uterine wall. Thrombophlebitis was found in nine cases, in six of which peritonitis was present as well. In eight of these nine cases one or both ovarian veins were thrombosed, and in the remaining case one femoral vein was affected. In all these cases the clot was heavily infected with streptococci, and suppurating, so that in many cases the vein had become a tube of pus. Abscesses of the uterine wall, visible to the naked eye, were found in 13 cases out of the 27. These varied from single abscesses to enormous numbers of small ones scattered through the uterine wall. They were generally more numerous under the placental site. In only one case was an abscess found directly communicating with the peritoneal cavity.

In addition to these naked-eye abscesses, microscopical examination of sections showed that in practically every case the uterine wall contained numerous thrombosed vessels, with streptococci in the clots. In many cases the streptococci could be demonstrated in the vessels up to within one or two millimetres of the peritoneal surface. It thus becomes quite evident that even when the uterine wall appears fairly healthy to the naked eye, it is generally, in these cases of streptococcal infection, heavily infected with streptococci throughout most of its thickness.

With regard to the other pelvic organs, one or both tubes were found to contain pus in nine cases. These cases all had generalized peritonitis as well, and it is probable that the tube infection was due to tracking back of the peritoneal exudate along the tube. The ovaries were only very rarely infected.

Nine cases showed empyema in one or both pleural cavities. Of these nine, eight had general peritonitis, and from the appearance and distribution of the pleural exudate, it is probable that, in some of the cases at least, the infection was due to a direct spread by lymphatics through the diaphragm.

Two cases, both of which had shown repeated positive blood-cultures for a week or more, showed an unsuspected endocarditis, with vegetations on the mitral valve. Neither of these patients had peritonitis.

The statement so frequently found in textbooks that cases of hæmolytic streptococcal septicæmia show laking of the blood and consequent staining of the endocardium and intima of the vessels, is not confirmed by our findings. The only cases in which we have found this appearance have been those in which there had been inadequate cooling of the body after death combined with a long interval between death and autopsy. It would thus appear that the staining is due solely to post-mortem growth of the streptococci or other organisms, such as the anaerobic bacilli, and has no relation to the disease in the living body.

Mixed hæmolytic and anaerobic streptococcus infection.—In this case both organisms had been isolated from the blood during life on several occasions. At the autopsy no general peritonitis was found, but there were firm adhesions between the pelvic meso-colon and the posterior wall of the uterus, between the omentum and

an inflammatory mass in the right side of the pelvis, and between the pelvic colon and the left broad ligament. On breaking down these adhesions, abscesses were found containing pus which, on culture, gave a pure growth of anaerobic streptococcus. At the same time cultures taken from the spleen and liver gave a pure growth of hæmolytic streptococcus, so that the organisms appeared to have sorted themselves out in the body. The only other feature of importance in this case was an extensive septic thrombosis of the right ovarian vein. The vein was enormously dilated, and filled with broken-down clot up to its entrance into the vena cava.

Other infections.—These include two staphylococcal infections, one anaerobic streptococcus, one infection by *B. fallax*, and a case from which *B. welchii*, *B. coli* and an anaerobic streptococcus were all isolated. In this last case death was apparently due to general peritonitis with hæmorrhage into the peritoneum, following on the sloughing into the peritoneum of an infected laceration of the left fornix. In the *B. fallax* infection also death was due to peritonitis.

The one case of pure anaerobic streptococcus infection showed lesions very like those in the case of mixed infection mentioned above. There were several areas of peritoneal adhesions which, when broken down, discharged thick green pus. There was also a large abscess in the pelvis, communicating with one in the buttock. Such localized areas of suppuration are very characteristic of the anaerobic streptococcus infections, and stand out in sharp contrast to the diffuse spreading infection of the hæmolytic streptococcus.

The two staphylococcal cases each showed much the same features, and in both the chief point was the formation of numerous metastatic abscesses, especially in the pelvic cellular tissue and the lungs. In one of these cases this spread was very extensive, there being innumerable minute abscesses scattered throughout the whole of both lungs, and also in the wall of the uterus, vagina, bladder and urethra. Two small abscesses were found in the one kidney. The other case in addition showed some peritonitis, localized to the lower half of the abdomen, and thrombophlebitis of one ovarian vein.

Conclusions.

(1) Early admission of cases, as soon as there is pyrexia during the puerperium, results in a very greatly improved prospect of cure.

(2) Every case of pyrexia in the puerperium should be examined bacteriologically. Causes of pyrexia often cannot be diagnosed by clinical methods alone, as, in many cases, gross pathological lesions give no clinical signs other than pyrexia. Cultures from the cervix, urine and blood are essential.

(3) The frequency of peritonitis in severe infections, and the high incidence of this complication in fatal cases, has been most strikingly brought out in this series. Peritonitis was present in 65% of the fatal cases.

The absence of clinical signs of gross pathological lesions is strikingly exemplified in peritonitis, which may give none of the classical signs when occurring during the puerperium.

(4) Thrombophlebitis, particularly of the ovarian veins, has been found in 30% of the fatal cases. It appears to be associated especially with an anaerobic streptococcal infection. Repeated rigors are almost pathognomonic of anaerobic streptococcal infection.

Classical "white leg" has not been associated with fatal infection in this series.

(5) The mortality rate of septicæmic infections varies very much according to the nature of the infecting organism. Cases with hæmolytic streptococci in the blood-stream had a mortality of 86%; those with anaerobic streptococci had a mortality of 30%; those with *B. coli* 20%. There is strong evidence that septicæmia is, in many cases, secondary to thrombophlebitis or general peritonitis.

(6) Hæmolytic streptococci were found in 42% of all the cases admitted. The greatest number of these cases followed a normal delivery. Anaerobic streptococci were found in at least 25% of all cases admitted, and were grown from the blood of ten cases. Unlike the cases infected by hæmolytic streptococci, every one of these ten cases followed a complicated labour.

(7) Drainage of the infected uterine and vaginal tissues, and of the uterine cavity, by the intermittent application of glycerine, has formed the basis of our treatment. With such treatment together with good nursing, in the open air as much as possible, a large proportion of the cases have made a good recovery.

(8) Organic arsenicals, particularly metarsenobillon, have been employed in 32 of the more severe cases. Most of the cases of localized infection have done very well but we cannot be certain whether the treatment has helped to prevent the development of peritonitis and septicæmia. In the peritonitis cases arsenicals appeared to have no influence and in the septicæmic group we have been unable, except in one or two instances, to sterilize the blood-stream, probably because most of them are being constantly reinfected from septic clots in large veins. There is at present no specific treatment which can be relied upon to control these infections.

(9) Very early drainage of the peritoneum in the cases of peritonitis, and late drainage (if required) of the cellulitis cases, seem to promise the best results.

Observations on the Pathology, Diagnosis and Treatment of Puerperal General Peritonitis.

By C. Oldfield, F.R.C.S., and L. N. Pyrah, F.R.C.S.

General peritonitis is one of the most insidious and serious catastrophies of the puerperium; owing to difficulty in diagnosis it is a condition which is very frequently missed until too late for effective treatment to be carried out.

The incidence of peritonitis in fatal cases of puerperal fever is very high. An examination of the autopsy records of the Leeds Maternity Hospital between 1924 and 1931 shows an incidence of 58% in the 26 cases which died from puerperal fever; these figures and those which I have been able to find in the literature indicate that peritonitis is present at autopsy in approximately one half of all fatal cases of puerperal fever (Table I). Although some of these cases have a blood infection, we believe that in most of them peritonitis is the proximate cause of death.

Table I.—Fatal Cases of Puerperal Sepsis showing the Incidence of General Peritonitis

	Total autopsies	Cases with general peritonitis	Percentage
Royal Society of Medicine, 1925 [1]	35	14	40
North of England O. and G. Society, 1925 [2] ...	49	23	49
Leeds Maternity Hospital, 1924-1931	26	15	58
Kneise [3] (quoted by Williams)	89	43	48
	199	95	48

The material upon which the communication is based consists of all the cases of general peritonitis in the Leeds General Infirmary between January 1, 1926, and December 31, 1931; these cases have been under the care of one of us [C.O.] and all have been operated upon by us. In addition are included those cases which occurred at Seacroft Fever Hospital between the same dates and which were also under the care of one of us [C.O.]; further, two cases (between the same dates) from St. James Hospital, Leeds, were communicated to us by Dr. J. Dick. The main points which have emerged from a study of these cases will be dealt with.

There were in all 36 cases; of these 25 died and 11 recovered after operation. In seven cases operation was not undertaken as the patients were almost moribund on arrival in hospital; a further six cases survived less than twenty-four hours after operation—so bad was their condition on arrival.

Pathology.

(1) *Pathogenesis.*—In nearly one-third of the cases some form of intra-uterine interference has been carried out; Table II shows figures for this and for some other series of cases. Surgical trauma is thus an important ætiological factor in allowing the entrance of infective micro-organisms.

Table II.—Cases of Puerperal General Peritonitis in which some Intra-uterine Operation has been Performed.

	Forceps delivery	Forceps and curettage later	Exploration of uterus	Curettage	Perforation	Evacuation of uterus	Criminal abortion	Dilatation of cervix	Totals interference	Non-interference	Total
Gordon [4], 1907	1	1	—	1	1	—	—	1	5	5	10
Wyatt [5], 1927-28	1	—	1	—	1	1	—	—	6	16	22
Pyrah and Oldfield, 1932 ...	6	1	—	—	—	—	2	—	9	22	31
									20	43	63

Peritonitis complicates labour more often than abortion. In this series five cases followed abortion and 31 followed full-term delivery. The infective organism in abortion is more frequently the staphylococcus and *B. coli* than the streptococcus and localized rather than generalized peritonitis results.

Infection by contact with an already infected case may be responsible for a series of cases of increasing virulence; the earlier cases of such a series show mild infections only, but the later ones are usually fatal from septicæmia and peritonitis. Such a series was recorded by Andrews, Maclean and Bourne [1].

The usual cause of peritonitis in the puerperium is an infection of the peritoneum from a focus in the genital tract; the infection usually spreads from the endometrium through the lymphatics in the corpus uteri, but it may result from an abscess in the uterine wall, in the ovary or the broad ligament or, very rarely, from a pyosalpinx. There are other occasional and relatively rare causes—gross trauma, infection from pre-existing tumours, and acute appendicitis; these have been discussed at length elsewhere [6]. We shall deal here only with peritonitis arising from a focus of infection in the genital tract; all the cases in this series and most of those which one meets in hospitals are of this nature.

(2) *Morbid anatomy.*—The most interesting changes are those which have been found in the uterus itself. The endometrium in the more virulent cases shows very slight inflammation. Microscopic examination shows a very imperfect development of the protecting leucocytic barrier which is present in cases of less virulence. Scattered groups of round cells and micro-organisms are seen. In cases of less severity a putrid endometritis may be found; this especially occurs in mixed infections.

The uterine muscle is softer than normal and, microscopically, shows lymphatics filled with streptococci. There are three lymphatic plexuses in the uterus—submucous, intramuscular and subperitoneal—and they intercommunicate freely. The greatest aggregation of uterine lymphatics is at the uterine cornua; here the larger collecting lymphatic vessels are found which carry the lymph to the aortic glands. This large lymph-plexus affords a ready means of direct extension of infection from the uterine mucosa, through the muscularis to the peritoneum. Evidences of lymphatic infection are the areas in the muscularis which are infiltrated by round cells; but very commonly at operation and at autopsy a macroscopic

uterine abscess is found; sometimes such an abscess has ruptured, resulting in general peritonitis, while in other cases peritonitis is associated with unruptured abscess.

Uterine abscess has been a prominent feature in this series; it has been present in 10 out of 36 cases. In six instances the abscess was situated at the right uterine cornu; it varied in size from that of a pigeon's egg to that of a golf ball, and was readily felt and seen at operation as a swelling bulging into the broad ligament. The peritoneal aspect of the abscess was covered with lymph, and sometimes the omentum was in part adherent to its wall. The abscesses contained thick green pus, and had evidently been present for several days—or, in some cases, weeks—before the peritoneal infection had supervened. In one case the abscess, resembling a large carbuncle in appearance, was situated at the left uterine cornu and was partly shut off by omentum and sigmoid colon. In two further cases the abscess was in the posterior wall of the uterus; in another, two or three miliary abscesses were found at autopsy.

The Fallopian tubes and ovaries were red and injected, and sometimes slightly swollen from œdema; if the tube be squeezed, occasionally a drop of sero-pus may exude, but this is never present along the whole length of the tube nor has a pyosalpinx ever been found in this series. The tubes were never sealed. Possibly the small amount of pus found in the tubes had entered from the peritoneal cavity. In one case in the series an ovarian abscess was found associated with general peritonitis. In a further case autopsy showed an abscess in the broad ligament which had followed an infected cervical tear; this abscess had, by spread of infection through the mesovarium, resulted in an ovarian abscess which had ruptured, causing general peritonitis.

The peritoneal inflammation is very variable in intensity. In the most acute cases the serous coat of the intestines—especially the coils lying in the pelvis—is much injected and stippled with hæmorrhage; here and there are deposits of fibrin and of lymph. There is either no pus or only a small amount of turbid fluid in the pelvis. Usually the abdomen contains large amounts of purulent or sero-purulent exudation, which is very abundant in the pelvis and collects in pools between the coils of intestines. The intestines are usually moderately or greatly distended, and are covered with patches of lymph.

In this series bacteriological examination of the pus from the abdomen was only made in seven cases: in all of them streptococci were found. All the cases, however, presented the pathological picture of streptococcal general peritonitis.

(3) *An analysis* of the cases has been made in order to try to correlate the pathological findings at operation and at autopsy with the clinical aspect and the prognosis of general puerperal peritonitis. The degree of severity of the infection, the incidence of local lesions in the pelvis, the association with symptoms and signs of a blood infection, the time which has elapsed between parturition and the onset of peritonitis, and the effects of treatment are all very variable factors.

While no rigid subdivision exists, it is possible to divide the cases into two groups:—

(A) *Early cases in which the peritonitis develops during the first four days after labour.* There are very virulent; they run a very rapid course characterized by severe toxæmia and usually by the absence of any localized inflammatory lesions in the pelvis. In very many a bacteræmia is present and the prognosis is always grave.

(B) *Delayed cases in which the peritonitis develops more than four days after labour.*—Several days or even weeks may elapse. In these a local pelvic inflammatory lesion is very often found—most often a uterine abscess or an abscess in the ovary or broad ligament and very rarely in the tube. The peritonitis results either from rupture of such an abscess or by slow permeation of organisms through its wall to the peritoneum. There is no bacteræmia and the prognosis is much better than for cases in Group A.

Table III shows this series of cases analysed from these points of view. Those with a short incubation period are rarely associated with a local lesion and have a very high mortality; those which have a longer incubation period are much more often associated with local lesions in the pelvis and with a considerably lower mortality.

Approximately half the cases fall into each group. Some of those in the second group have occurred two, three, four and seven weeks after labour—they are then commonly associated with uterine abscess. The cases in Group A are more often to be found in maternity hospitals; those of the second group have often been discharged from such a hospital and have usually had little evidence of puerperal infection until they are re-admitted into the surgical and gynæcological wards of a general hospital with peritonitis.

TABLE III.—RELATION BETWEEN TIME OF ONSET AFTER LABOUR, PRESENCE OF LOCAL SUPPURATIVE LESIONS IN THE PELVIS, AND MORTALITY.

Time between Labour and Onset of Peritonitis.

4 days or less = 15			*More than 4 days* = 18			*No note available* = 3		
Died		Recovered	Died		Recovered	Died		Recovered
13	...	2	10	...	8	2	...	1
Local lesion present		No local lesion	Local lesion present		No local lesion	Local lesion present		No local lesion
3	...	12	8	...	10	—	...	3

SYMPTOMATOLOGY.

Do the symptoms and signs of early and delayed cases show any marked difference?

A study of our cases shows that they do, but it must be understood that the division between them is not absolutely rigid.

(1) *Early cases.*—In these the patient is known to be suffering from puerperal fever before the onset of peritonitis, by the elevation of the temperature and pulse-rate. The onset of peritonitis is accompanied by a *gradual change for the worse in the general condition of the patient.* There may be a rigor and the temperature and pulse-rate are raised subsequently. The patient may be able to take food and may even acknowledge a feeling of well-being. Abdominal symptoms may be very slight—in one case the patient never complained of abdominal pain—but usually there is abdominal discomfort and in most cases definite pain is complained of. The pain or discomfort may pass off, thus misleading the observer. Diarrhœa, when present as an early symptom, is very suggestive of peritonitis.

The physical signs in the abdomen are very few and difficult to interpret. Gradually increasing distension of the lower abdomen, spreading upwards, is the most important early symptom; the abdomen frequently becomes drum-like before death. Abdominal tenderness is nearly always present, though occasionally the patient will not admit that there is any. Cutaneous hyperæsthesia is frequently present. Rigidity of the abdominal walls is usually absent. Free fluid in the abdomen is present in advanced cases, but by the time this is detected the case is hopeless. The decision to operate must often be taken upon the most indefinite of physical signs.

(2) *Delayed cases.*—These cases sometimes show clinical evidence of puerperal infection before the onset of peritonitis. In very many the infection subsides in two or three days; very often no evidence of puerperal infection is discernible before the patient is admitted to hospital with general peritonitis many days, or even weeks, after labour.

The onset of peritonitis in this group of cases tends to be sudden rather than gradual, and is usually signalized by the *triad of symptoms of a rigor, abdominal pain*

and greatly increased pulse-rate; when this triad is present peritonitis must always be seriously considered. After the rigor the temperature rises again and the pulse remains higher than 120, often being 140 or more. Abdominal pain is nearly always severe, sometimes agonizing. It is usually continuous in character but sometimes it occurs in severe paroxysms. At first it is referred to the centre of the abdomen or to the hypogastrium, becoming generalized later; in cases in which a uterine abscess is present the pain is at first localized on the same side as the abscess.

The patient appears to be very ill and wears an anxious expression—the eyes are hollow and the cheeks sunken; she lies quite still. There are always definite physical signs to be found in the abdomen in this group of cases. Rigidity of the abdomen is always found and is especially prominent in the cases which occur a long time after labour. Tenderness of the abdomen was present in every case except two and it is usually generalized. Distension of the abdomen occurs as in early cases. A mass corresponding to a uterine abscess was found in two cases but normally a bimanual examination reveals nothing but tenderness over the position of the uterus.

Diagnosis.

The diagnosis of general puerperal peritonitis is always difficult. A gradual but persistent change for the worse in the general condition, associated with abdominal discomfort and distension are the important features of early cases; a sudden change for the worse associated with the triad of rigor, abdominal pain and greatly increased pulse-rate are typical of later cases. The anxious facies and the rapid pulse, of low tension, are important signs. Progressive abdominal distension is invariable and rigidity of the abdomen is usually present in delayed cases but very often absent in early cases.

In cases of local peritonitis associated with a palpable mass in the pelvis the patient does not look so seriously ill, the abdominal pain is usually well localized and the pulse-rate does not show the combination of rapidity and low tension.

Treatment.

We believe operative treatment to be essential in every case in which puerperal general peritonitis is diagnosed if it is due to any organism other than the gonococcus; we have no reliable evidence that any such cases have recovered spontaneously.

Open ether or gas-and-oxygen are the anæsthetics of choice; spinal anæsthesia is definitely contra-indicated. Local anæsthesia with simple drainage may be used in emergency, without moving the patient into an operating theatre.

Drainage of the peritoneal cavity should always be done by the abdominal route. An adequate incision, sufficient to admit the whole hand, is the simplest means of ensuring evacuation of pus and of making a rapid exploration of the pelvic viscera. Drainage by the vaginal route may be used as a subsidiary method if time permit but it fails to allow adequate drainage and exploration of the pelvic organs, so it should never be used alone.

If an abscess be found in the uterus or in the broad ligament it should be packed off, opened by sinus forceps and drained by a rubber tube; if an ovarian abscess be found the ovary should be removed. If no localized focus of suppuration be found in the pelvis, the uterus itself must be responsible for the infection. Hysterectomy has been advocated for such cases and also for uterine abscess complicating general peritonitis. With the single exception of puerperal peritonitis associated with a sloughing fibromyoma uteri, we believe that hysterectomy should never be performed in the presence of general peritonitis. Hysterectomy has been performed on the supposition that it removed the entire primary focus of the disease. By the time peritonitis is established the whole of the pelvic lymph-plexus is infiltrated with streptococci and hysterectomy cannot possibly remove the whole of the primary focus; such an operation must result in the opening up of new lymphatic vessels for the further absorption of organisms.

COMMENTARY.

It has been frequently stated that puerperal general peritonitis is always a terminal event in a puerperal blood infection, and must therefore be always fatal. If this view be held it would be natural to withhold operative treatment. The object of this communication has been to show that in very many cases puerperal peritonitis is associated with—and caused by—a localized focus of suppuration in the pelvis, and that therefore operative treatment at the earliest possible moment is indicated.

We believe that the association of septicæmia and peritonitis is not so common as has been supposed, and this applies especially to those cases in which peritonitis develops later than the first few days after labour. The reasons for the belief that puerperal peritonitis is more often a local disease than a terminal event in a septicæmia are as follows:—

(1) The peritoneal inflammation is most intense around the uterus and around a local pelvic suppurating focus, and becomes progressively less further away, exactly as as in the peritonitis due to acute appendicitis.

(2) Streptococcal infections in any part of the body—finger, cellular tissues, joints—often mimic a septicæmia, as they are associated with a high swinging temperature and a rapid pulse-rate. That this is due to toxæmia and not septicæmia is evident by the frequent recovery of such cases and by the absence of a positive blood-culture. The same applies to puerperal peritonitis.

(3) The prognosis in puerperal general peritonitis—apart possibly from a few cases arising shortly after labour—depends upon how advanced the condition is at the time of the operation. If septicæmia were also present no such clinical rule could be formulated.

(4) A positive blood-culture is by no means always present in patients with puerperal peritonitis.

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Discussion.—Mr. J. M. WYATT said that with regard to the first paper, the rapidity with which the tables of figures had been thrown on the screen made them a little difficult to absorb completely, but under the heading "septicæmia" he thought the mortality rate was low owing to the somewhat large number of cases of anaerobic blood infections being included. He agreed that in about 40% of all cases of puerperal infection the hæmolytic streptococcus was the organism concerned, but he himself had found in analysing his own cases, that in the severe types of infection, viz., septicæmia and general peritonitis, in 79 cases, 87% were due to this organism.

In regard to the *B. coli* cases, he wondered whether jaundice had been present in the cases of blood injections and whether the ketonic diet had been used for patients running a high temperature.

With regard to peritonitis, he was a little uncertain in regard to the very early operation, i.e., before there were any signs of generalizing, since, out of 183 cases under his care, in 96 there was no evidence of spread above the umbilicus, 93 had made good recoveries, and of the three deaths, two were from pulmonary emboli; in 87 cases of generalized peritonitis in which he had performed laparotomy 24 patients had recovered.

He was surprised that Professor Oldfield and Mr. Pyrah had not found a sudden acute diarrhœa a common symptom of general peritonitis, as he had noticed it in certainly over 70% of his cases.

Dr. MALCOLM DONALDSON said that, from Mr. Rivett's figures he was not quite convinced of the value of early exploration of the abdomen. It was difficult to see of what value a drainage tube could be when there was little or no fluid in the abdomen. The peritoneum's mode of defence was to pour out fluid, and it was only when sufficient fluid had accumulated to prevent further secretion that drainage was of any value. He understood that in the cases quoted by Mr. Rivett there was little or no fluid at the time of exploration.

Mr. CLIFFORD WHITE said he was surprised that more stress had not been laid on the importance of the pulse-rate in diagnosis. He had seen cases in which, for a time, the only sign had been an increasing pulse-rate—all the other signs and symptoms being absent. Then quite quickly the classical signs of established peritonitis had become obvious. In his opinion the description given by Professor Carlton Oldfield was that of *established* and not really *early* peritonitis. To obtain good response to treatment it was no use waiting for the appearance of all the classical signs and symptoms.

Dr. O'DONEL BROWNE (Dublin) said he would like to ask Mr. Rivett what was his exact technique in obtaining cultures from the uterine cavity.

He felt that insufficient attention could be paid to clinical findings, and agreed with Mr. Clifford White regarding the importance of pulse-rate. Subinvolution of the uterus was also of the greatest importance. When this condition was associated with fœtid lochia, between the eighth and tenth days of the puerperium, especially if there was any uterine irregularity or tenderness, with suggestion of fixation, the case was eminently suitable for hysterectomy. Once there was either general peritonitis or septicæmia, operation was of no avail.

Professor OLDFIELD (in reply) said that statistical tables relating to the incidence of puerperal sepsis would be more helpful towards the settlement of the important question of the origin of infection if the cases were divided into those patients who had been examined vaginally and those who had not had any such examination before, during, or after labour. From his long experience of puerperal sepsis, he had concluded that infection was introduced into the passages before, during, or after labour in practically all cases. As to treatment he considered that intra-uterine applications were unnecessary and not free from danger. Moreover, he thought that sera, vaccines, pituitary extract, and other forms of medication were useless and not free from the risk of hindering the recovery of the patient, although it was not uncommon to see a patient's temperature drop suddenly after any form of treatment.

With regard to puerperal general peritonitis, he wished to add a word or two on early diagnosis. Early diagnosis was sometimes difficult, and the most important point was a change for the worse in the general condition of the patient. Pain was usually severe, but occasionally it was not a prominent feature. Similarly, distension, vomiting and diarrhœa, and rise in pulse-rate and temperature were variable in their incidence and severity. He agreed with Mr. Clifford White that acceleration of pulse-rate was a very important sign.

Mr. RIVETT (in reply) said he was much interested in Professor Oldfield's and Mr. Pyrah's paper in that it recorded so many cases of peritonitis appearing late in the puerperium. In reply to Professor Oldfield he suggested that the fact that in three cases of "B.B.A." the patients had died from peritonitis was strong evidence that infection could occur without interference. Professor Oldfield had said that the diagnosis of peritonitis was easy. They had not found it so at Queen Charlotte's Hospital, and in five cases had only discovered it post mortem.

In reply to Mr. Donaldson, Mr. Rivett agreed that in some of these early cases a diagnosis of peritonitis could not be established when no organism had been found at the operation, The fact that recoveries had taken place except when the blood was also infected satisfied him that the exploratory operation did no harm.

Section of Comparative Medicine.

President—W. Horner Andrews, M.R.C.V.S.

[*April* 26, 1933.]

DISCUSSION ON STERILITY.

Factors Producing Sterility, with Special Reference to Genetic Causes.

By John Hammond.

(*School of Agriculture, University of Cambridge.*)

The causes of sterility are numerous and complicated, and for the sake of clearness are best considered with reference to the stages of the reproductive process at which the fertility of an animal is controlled. The factors which reduce the size of a litter in species producing many young at birth are similar in nature to those which produce sterility in a species normally producing only one young at birth.

There are three main phases of the reproductive process at which fertility is controlled: (1) The number of ova shed; (2) The number of ova fertilized; (3) The number of fertilized ova which develop to the time of birth.

Each of these will now be considered in detail.

(1) *The number of ova shed.*

This depends on the level of what was formerly known as "generative ferment" (Heape [1], Hammond and Marshall [2]), but now shown to be anterior pituitary substance (Zondek and Aschheim [3], Smith and Engle [4]), in the blood. When, in the rabbit, one ovary is removed, the surviving ovary will ripen a number of ova similar to that of the intact animal with both ovaries (Asdell [5]). Injections of anterior pituitary substance will also increase enormously the number of ova shed. Since the presence of the functioning corpus luteum (cow—Hammond [6]) and heavy lactation (rabbit—Hammond and Marshall [2]) also use up this substance, the production of ova may be prevented by these causes. In early life too, when the growth of cartilage and bone is requiring the output of the anterior pituitary, the ripening of ova does not occur, unless injections are made. In young growing animals (pigs) shortly after puberty the number of eggs shed is less than that later in life (Hammond [7]).

The best measure of the conditions suitable for egg-production is to be obtained in the fowl, where the complications of corpora lutea and lactation do not exist. It is well known that there are genetic differences in the production of eggs by the fowl: some strains (White Leghorns) will lay over 200 eggs in the year and others (Silkie) only 50, or less. Now the rate of egg production in the fowl, particularly in the low-producing strains, varies with changes in the hours of daylight, whether these be seasonable in any one latitude or due to differences in latitude (Whetham [8]). It is supposed that light stimulates the anterior pituitary by way of the eye and that in autumn with decreasing daylight, fowls with a genetically low level of anterior pituitary will fall below the critical level for egg production and so sterility from this cause will result. It is during the autumn and winter months that the low-producing strain (Silkie) cease laying. In some mammals very much the same sort of thing occurs; ferrets which do not normally ripen ova during the autumn and winter months may be made to do so by giving them electric light after dark (Bissonnette [9]). We can assume therefore that the genetic constitution of the ferret is such that its pituitary activity is dependent upon light stimulation.

It is probably the *change* in the light ration—not the actual amount—which is the cause of the stimulus to the anterior pituitary, for most breeds of sheep begin to ripen ova with declining daylight in September and cease with increasing daylight

in February. Some breeds (Dorset Horn), however, have a much longer breeding season than others, and here again genetic differences are apparent. Just as fowls can be bred for different levels of egg production, so can mammals be bred for a constant number of eggs shed at each ovulation. Two strains of rabbits have been isolated by inbreeding, one of which sheds six eggs and the other twelve eggs; when these strains are crossed the inheritance is of the multiple factor or blending type, each cross and back cross being intermediate between the parents (Hammond [10]).

(2) *The number of ova fertilized.*

It is, of course, impossible to get fertilization when an upset in the chromosome complex occurs, such as is met with in the mules produced from crosses between different species. Even, however, when the ova and sperm are quite normal in this respect, fertilization frequently fails to occur. The fertilization of the ova depends on the presence of a sufficient number of sperm at the tops of the tubes at the right time—just after ovulation has occurred.

The ova are capable of fertilization for only a short time after ovulation. In the ferret, where their passage down the tubes is rather slow, a mating with a fertile male made sixty-six hours or more after mating with a sterile (vasectomized) one to induce ovulation (which occurs at thirty hours) fails to produce young, while matings made at forty-eight to sixty hours produce small litters or nothing. This shows that the ova can only be fertilized for a period of thirty hours or so after ovulation. In the rabbit, in which the passage down the tube is faster and a layer of albumin soon coats the ova (Pincus [11]), they can only be fertilized during a period of six hours after ovulation; and as the time at which the sperm are inserted (by mating with a fertile male at different intervals of time after a vasectomized male to induce ovulation) is moved from ten hours before (normal) to two hours before and then two hours after the time of ovulation, so the average litter size and the number of does becoming pregnant is reduced until absolute sterility is obtained (Hammond [12]).

The rate at which sterility is obtained in this case depends on the type of sperm swarm of the male used. The term "sperm swarm" is used in the statistical sense to denote the mode in which the sperm ascend to the tops of the tubes; it is dependent on the motility and vigor of the sperm as well as on the number in the semen. If rabbits are inseminated with successive dilutions of semen, first full fertility is obtained, then small litters, and afterwards sterility, while there are still considerable numbers of sperm in the fluid (Walton [13]). Similarly the semen of certain males may fall below the sperm content necessary to cause fertilization, for although only one sperm is required to fertilize an ovum the chances of any one sperm reaching the ovum at the right time are very small.

Differences between the sperm swarms of different males may be measured by mating a recessive coloured female with a dominant coloured and, at the same time, or after an interval, with a recessive coloured male, and counting the number of ova fertilized by each. For example, Table I shows the results obtained in one such experiment with two different strains of rabbits:—

TABLE I.

Does	Mated with buck			Number of young born from buck used at	
	10 hours before ovulation		4 hours before ovulation	10 hours	4 hours
F strain (albino)	C strain (black)	...	F strain (albino)	... 75	... 2
	F strain (albino)	...	C strain (black)	... 46	... 38

This shows that the sperm swarm for the C strain male was much larger than that from the F strain male, illustrating again differences in genetic constitution. The size of the sperm swarm too will depend on the time of the mating in relation to the time of ovulation, and if mating takes place a long time before ovulation occurs the chances of the sperm surviving will be small. For example, with our travelling

stallions, where service may occur at any time during the heat period (which frequently extends to fifteen days or more), the average fertility over the whole country is only about 53% (Sanders [14]); but individual stallions vary (over an average of several years) from 20% up to 75%, depending on the size of their sperm swarm. Whether these differences are genetic or environmental (nutrition, management, etc.) is not known.

There is an optimum time of mating in relation to the time of ovulation in each species, as the following results (Table II) obtained with mares show.

TABLE II.

Mating made at days before the end of heat	13	11	10	9	7	6	5	4	3	2	1
Per cent. fertility ...	0	0	0	0	29	50	67	67	50	62	20

Stallions with large sperm swarms will get foals from matings made over a larger range of time than will stallions with poor sperm swarms. Lack of sperm in the semen tends to behave as a recessive character and so comes out on inbreeding.

(3) *The number of fertilized ova which develop to the time of birth.*

While fœtal atrophy causes reduction in the litter size of animals such as the pig and rabbit, it is a cause of sterility in those species, such as the cow, which only produce one young at birth. While many factors, such as removal of the ovaries, lactation, etc., may cause absorption or abortion of the young in an animal with a litter such as a rabbit, these cause the death of all the fœtuses and not some only such as occurs in fœtal atrophy.

In some cases, such as that of the yellow mouse, fœtal atrophy is caused by lethal factors, the embryos carrying the homozygous gene being incapable of development beyond a certain stage, although those having but one dose of the gene are able to survive and hand on the character to successive generations. In the rabbit, however, fœtal atrophy, although inherited, is mainly a maternal character and is shown by the doe irrespective of the male with which she is mated (Hammond [12]). A strain has been produced in which on the average 60% of the embryos perish before the time for birth occurs, and, although on the average 12 ova are shed, on the average only four normal young are produced. This is a recessive character and is probably the main cause of the lowered fertility which is frequently found on inbreeding, for other strains in which the character is not present do not show reduced fertility when inbred.

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Sterility in Relation to Endocrine Deficiency.

By A. S. PARKES.

CERTAIN of the endocrine organs, such as the thyroids, parathyroids, and adrenals, play a part in maintaining the general condition of the animal, and are therefore essential for fertility without being directly associated with reproduction. I propose, however, to limit my remarks in this paper to the endocrine organs directly concerned with the reproductive processes. These are the gonads and the anterior lobe of the pituitary body.

The production of living young is the result of a chain of events, of which many of the links are endocrine in nature, and sterility may result from a breakdown at any point in this long sequence of processes. I shall adopt the same general form of classification as Dr. Hammond. Firstly, spermatozoa and ova must be produced; secondly, fertilization must be achieved, which includes the fact that coitus must take place; thirdly, the fertilized ova must be gestated, and normal parturition must occur; finally, in the majority of mammals some sort of adequate lactation must take place if the young are to be reared.

I shall first examine the endocrine factors involved in the general co-ordination of the reproductive processes. For many years it has been known that the changes in the accessory organs of reproduction are controlled, largely or exclusively, by chemical substances—hormones—produced by the gonads. Much more recently it has become known that the cycle in the gonad itself, particularly in the ovary, is controlled by one or more hormones produced by the anterior lobe of the pituitary body. Thus, there is a cycle in the accessory organs controlled by the cycle in the ovary, which in turn is controlled by the hormones of the anterior pituitary lobe. The discovery of the anterior lobe mechanism has merely transferred the problem of reproductive periodicity to another gland, without bringing nearer a knowledge of how the cycle is initiated.

The first necessity for fertility is the production of germ cells. Dr. Hammond mentioned that ovulation is under the control of the anterior lobe. In the male mammal the same sort of correlation is not found; the administration of anterior lobe to immature males does not result in premature spermatogenesis. The endocrine part of the testes increases in size, and the tubules undergo some development, but spermatogenesis has not been obtained in the mammal by treatment with anterior lobe preparations. It is necessary, therefore, to assume that some other factor is needed, in addition to anterior lobe, to cause spermatogenesis.

With regard to the production of ova, we know that the development of the Graafian follicle and its increase in size to the point of ovulation is caused by the secretion of anterior lobe substance. On the other hand, the initial production of ova from the germinal epithelium is not under the same control. Hypophysectomy causes the ovary to degenerate as far as all appreciable follicles are concerned, but even in long-standing hypophysectomies perfectly normal primordial ova surrounded by one or more layers of follicular epithelium are still found.

The next stage, the achievement of fertilization, depends, in its first stages, on endocrine activity. Firstly, the spermatozoa have to be introduced into the vagina, and this involves the act of coitus, which depends on endocrine activity. In practically all our laboratory mammals coitus will only take place when the animal is in the required condition of œstrus. In particular this condition is characterized by changes in the vagina which are designed to facilitate coitus. The ferret develops an enormous swelling of the vulva, and this is necessary if coitus is to take place. Certain primates—e.g., the baboon—undergo enormous development of the vulva before ovulation. Secondly, there is the less understood condition of the female at œstrus, the state of being willing to receive the male; this essential preliminary to fertilization seems to depend fundamentally on endocrine activity. As regards the male, much the same conditions, though rather less complex, are necessary. In particular, if fertilization is to be achieved, the medium in which the spermatozoa are transferred has to be produced by accessory reproductive glands of the male, and the development of these depends on the endocrine activity of the testes.

Dr. Hammond has outlined the factors operative in securing fertilization after insemination and these are mathematical and mechanical rather than endocrine.

The third stage is pregnancy. The fertilized egg has to be implanted into the endometrium, and before this can occur, very definite changes, as compared with the period of ovulation, are required. In most animals there is a distinct

morphological change, largely glandular, of the endometrium immediately after ovulation. Also, there is a condition of increased sensitivity to mechanical irritation. This is demonstrated by the fact that a thread drawn through the lumen of the uterus causes the development of a block of decidual tissue. At other times in the cycle this reaction to irritation is not found. Most mammals show both the glandular development and the increased sensitivity of the endometrium after ovulation. Some, however, show only the physiological sensitivity. These changes in the endometrium are known to be under the control of the substances produced by the corpus luteum, and they are absolutely essential for implantation to take place. The capacity of the endometrium to implant fertilized ovum is only short-lived, and fertilized ova arriving at the wrong time cannot be implanted. In the rabbit this time is probably only about three or four days, but the glandular development of the endometrium lasts from ten to twelve days.

The next point is the capacity of the mother to tolerate the fœtus—really a foreign body—and to carry the gestation process through to its desired end. I have said that the corpus luteum is essential to cause the initial changes required for implantation of the ovum, and to that extent the ovaries are essential in the early stages of pregnancy. Whether the presence of the ovary is required for the rest of gestation is a debated point; it probably depends on the species examined. In certain species, at any rate, the presence of the ovaries is essential during the whole gestation if normal young are to be produced.

As to the endocrine factors involved in parturition, I may mention some experiments which are of special interest to clinicians. I refer to the work of Dr. Philip Smith, on the effect of removing the posterior pituitary body. It is possible for rats to experience a normal sexual cycle, and therefore to become pregnant, without the posterior pituitary lobe. Smith's experiments have shown that parturition may be quite normal in the complete absence of the posterior lobe, and that the oxytocic principle of this gland is not essentially necessary for the performance of normal labour.

Sterility in Males on Diets Deficient in Vitamin A or Vitamin E.

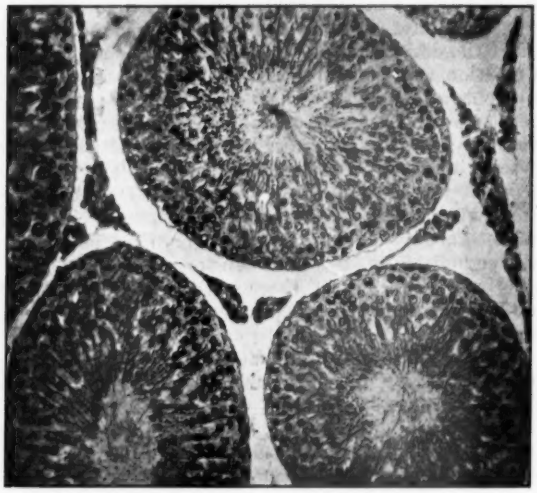
By V. KORENCHEVSKY, M.D.

AS is the case with most pathological conditions, sterility may be produced by two main causes: (1) Local causes, acting on a special organ or tissue, as for example, local infection of the uterus; (2) general causes, acting on the whole organism, on many organs and tissues, among which the sexual organs might be involved. For example, general undernourishment, a deficiency in special vitamins or salts, etc.

I would, however, strongly emphasize the fact that in many cases a local cause alone—i.e., without simultaneous action of a general cause—could not produce a pathological condition. Thus, taking the example which has already been given, local infection of the uterus may be without effect, or may produce slight, or most severe metritis, the difference depending on a good or a poor resistance of the organism towards bacteria.

The disease produced by a local cause, therefore, is usually the result of the action of this injuring cause and the counter-action, in a greater to less degree, of the resistant power of the organism. This is corroborated by the observations of Mellanby and his co-workers on the incidence of puerperal infections in women to whose diet no addition or extra amount of vitamins A and D had been made; and also, by their experiments on rats fed on a diet rich or poor in vitamin A.

However, besides this indirect effect of vitamin A, which might be especially important in the sterility of females suffering from infection of their sexual organs, there is also a direct sterility-producing effect of deficiency of some vitamins.



Sections stained with hæmatoxylin-eosin.

FIG. 1.—Testis of rat, 85 days old, on a complete diet fed in an amount equal to that consumed by the litter mates kept on vitamin-A-deficient diet (see fig. 3). Normal structure of testis. × 150.

FIG. 2.—Testis of rat, 56 days old, fed on vitamin-A-deficient diet for thirty-five days. Beginning of first stage of degeneration; swelling, fusion and irregular disposition of some spermatozoa. × 150.

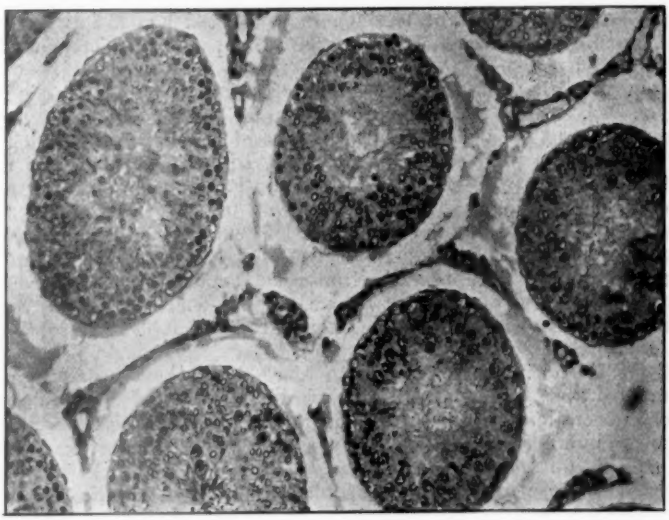


FIG. 3.—Testis of rat, 85 days old, fed on vitamin-A-deficient diet for fifty-two days. Stages 1 (predominant) and 2 of testicular degeneration; deformation and fusion of spermatozoa, swelling of cells, beginning of desquamation of cells and of appearance of beadlike nuclei. × 150.

FIG. 4.—Testis of rat, 58 days old, fed on vitamin-A-deficient diet for thirty-five days. Stage 2. Beadlike appearance of nuclei. Some nuclei show pyknosis or karyorrhexis. Desquamation of the cells into the lumen of tubules. × 90.

In the following I will summarize the results obtained on male rats by myself and my co-workers in which the sterility was produced by deficiency of vitamin A (Sampson, Dennison and Korenchevsky, 1932 ; Sampson and Korenchevsky, 1932, *a* and *b*), and of vitamin E.[1]

Similar results have been obtained by other workers (see references in *Med. Res. Counc. Spec. Rep. Series*, 1932, No. 167, " Vitamins ").

If rats are placed on a diet deficient in one of the vitamins mentioned above, profound changes are produced in the testes. In vitamin-A-deficient rats these appear after about three weeks and in vitamin-E-deficient rats, after about two months of deficient feeding.

Whilst the general condition of vitamin-A-deficient rats declines towards the end of the experiment, that of vitamin-E-deficient rats is good, and these rats do not differ greatly in growth and appearance from normal control rats.

Changes in the testes of rats kept on a vitamin-A-deficient diet are very similar to those in the testes of rats kept on a vitamin-E-deficient diet, or to those which appear in cryptorchid testes.

We divide the changes in testes into four stages, these usually appearing in succession. However, although there is always a predominating stage of degeneration, when the degeneration of the testis is advanced, different stages may be present simultaneously in different tubules.

Stage 1. Initial degeneration of seminiferous tissue.—This stage is chiefly characterized by degeneration of the spermatozoa. First, swelling occurs at the junction of the head and tail and spreads to include the whole head. Then the tails undergo similar degenerative changes. The individual spermatozoa coalesce and chromolyse into irregular masses of chromatin. At this stage, in many cases, a swelling and desquamation of the seminiferous epithelium and accumulation of œdematous fluid in the intertubular spaces are also present.

Stage 2. Intermediate degeneration of seminiferous tissue.—Spermatozoa are scarce or absent. Seminiferous cells are rather swollen. The lumen of the tubules is, therefore, considerably reduced, disappearing completely in some tubules. Vacuolated spaces appear between the cells, due to the plasmolysis of the cytoplasm and probably to the œdema. The nuclei of the spermatids undergo degenerative changes and acquire a characteristic bead-like appearance. The accumulation of œdematous fluid in the intertubular spaces is greater than that in a first stage.

Stage 3. Advanced degeneration of seminiferous tissue.—Multi-nucleated giant cells appear, forming ovoid or round masses of fused cytoplasm of the spermatids, containing from two to forty—or even more—spermatid nuclei. The nuclei are in different stages of degeneration—pyknosis, karyorrhexis or liquefaction. The giant cells, especially towards the end of this stage, also undergo degeneration and liquefaction. Next, spermatocytes and spermatogonia begin to show severe degenerative changes—pyknosis and karyorrhexis of the nuclei and desquamation into the lumen. In the tubules the vacuolated spaces are more evident. These are formed by the separation of protoplasm or by the liquefaction of the nuclei or the cytoplasm of the cells.

Stage 4. Final degeneration of the seminiferous tissue.—The tubules are reduced in size and consist only of a syncytium of Sertoli cells, of which some of the nuclei have wrinkled outlines. Otherwise these cells do not show any significant changes. The protoplasm of the cells has a fibrous structure. The interstitial Leydig's cells are unchanged.

Sterility may appear as early as the first stage of degeneration.

In vitamin-A-deficient rats, vitamin-A deficiency, and not the accompanying loss of appetite, was found to be the cause of the decreased size of seminiferous tubules

[1] The detailed experiments on vitamin-E-deficient rats will be published shortly.

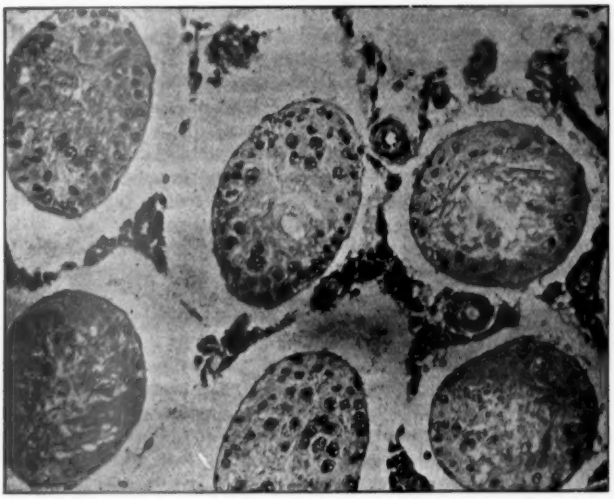


FIG. 5.—Testis of rat, 168 days old, fed on vitamin-E-deficient diet for 147 days. Stages 3 and 4. Very severe degeneration of the seminiferous cells. In most tubules the protoplasm of individual cells fused in syncytium, having fibrous appearance. × 150.

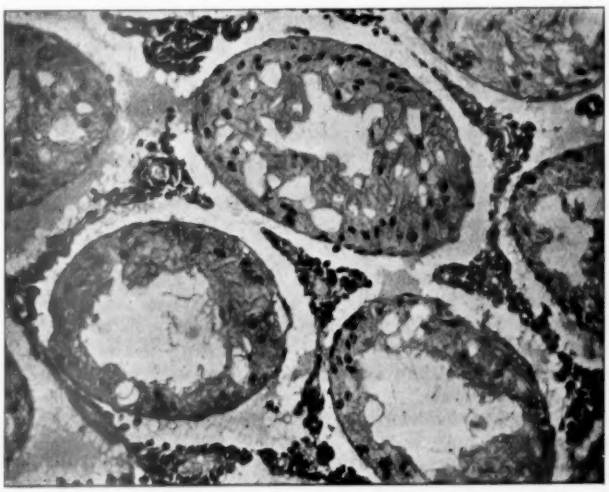


FIG. 6.—Testis of rat, 168 days old, fed on vitamin-E-deficient diet for 147 days. Tubules contain only syncytium of fibrous protoplasm almost only of Sertoli's cells. Vacuolated spaces in protoplasm. × 150.

and of the degenerative changes produced in the seminiferous epithelium of the testes. The administration of an additional amount of vitamin E in the form of wheat-germ oil did not prevent the degeneration of the testes of rats kept on a vitamin-A-deficient diet. The changes in body-weight which occurred towards the end of the experiment seemed to have no effect on the degree of severity of the degeneration of the testes, while the greater durations of the experiment were accompanied by more severe changes.

When calculated for the same unit of body-weight, the weight of the testes showing the first or second stages of degeneration was greater in the rats kept on vitamin-A-deficient diet than that of the paired rats on complete diet. This might be explained chiefly by the œdema of the testes, and possibly also by the swelling of the seminiferous cells at these stages. At Stage 3, and more especially at Stage 4, the weight of the testes was smaller, owing to the fact that at these stages atrophic changes of the seminiferous tissue were great, thus decreasing the weight of the sexual glands and outweighing the influence of œdema on the weight of the testes.

The restriction of the ration of complete diet in our experiments did not produce any significant changes in the actual weight of testes, in the size of the seminiferous tubules or in their histology owing to the fact that such a small limitation was necessary that the rats were able to be kept in a healthy condition.

When calculated for the same unit of body-weight, the weight of the testes of paired rats on a complete diet restricted in amount was slightly larger than that of the testes of rats on complete unlimited diet. This was explained by selective protection of sexual glands in the organism. However, when the restriction of the diet amounts to severe starvation, degeneration of the seminiferous tissue appears, as is shown by the experiments of Siperstein (1921); though the selective protection of the sexual glands in the organism is so highly developed that after acute inanition in adult rats, which lost as much as 47% of their body-weight, degenerative changes were present in only comparatively few tubules, the other seminiferous tubules showing apparently normal structure (Siperstein, 1921).

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Infectious Sterility in the Larger Domesticated Animals.

By J. T. EDWARDS.

(*Lister Institute.*)

AT the outset I wish to thank Messrs. Pool and Edwards, of the Imperial Bureau of Animal Health, for kindly placing at my disposal valuable sources of world information, which would otherwise have been inaccessible to me. The diseases of reproduction, including sterility, are now exercising the attention of breeders and veterinarians almost more than any other problem with which they have to contend in our domesticated animals.

From what has been said already in the discussion you will have gathered that the causes of sterility may well be classed in the light of present-day knowledge under the following headings :—

I. Genetic.
II. Functional { Endocrinal. / Nutritional.
III. Infectious.

A brilliant French lecturer, Professor V. Robin [1] of the Alfort Veterinary School, speaking on this subject some time ago, likened the matter of sterility to the condition in a contractor's yard where material of all sorts, sizes and shapes was dumped, by all kinds of people, so that it almost surpassed the wit of the builder, however ingenious, to construct a suitable edifice from it.

There is in veterinary writings, especially in the reports of the annual conferences of the German Veterinary Specialists on Breeding Diseases, a growing tendency to attach more and more importance to the first two headings of classification given above. Besides the information given by the preceding speakers, on the significance of functional derangements, the valuable observations made by Sir Arnold Theiler [2] and his colleagues (who referred briefly to this subject at the last meeting of this Section) upon the effects of certain mineral deficiencies upon fertility may be cited.

The classification is not, however, that usually given by veterinary writers the prevailing impression being that sterility is commonly the result of recognizable disease of the genital tract, again the consequence of bacterial infection, which has invaded the tract from the outside world. One may even detect a note of indignation in Professor Robin's lecture when he comes to treat of the suggested possibility that infertility among animals in France may be caused by some deficiency in their food.

There is indeed much ground for holding the view that the chief cause of sterility in our larger animals is some form of infection. Abortion, which is of frequent occurrence, and often takes the form of extensive outbreaks, in both the equine and bovine species, is produced, in the great majority of cases, by specific infection. The causal bacteria, which are different in the two species, have now been extensively studied. And in the bovine species, more particularly, infectious abortion seems to leave in its train a number of other breeding troubles, such as premature births, retained placentas, diseases of the new-born and sterility. Veterinarians with wide clinical and obstetrical experience, therefore, have often been found to link up these conditions and assign to them a common origin. The assembling of the so-called reproductive diseases in this manner has, however, tended to offend the good sense of the bacteriologist, impressed as he has been by the diversity of the bacterial flora recoverable from the several conditions and the differences in their pathogenic effects.

Sterility in the larger domesticated animals is a subject which has attained a commanding position during the last thirty years in western countries. This has coincided with the disappearance of the great epizootic diseases, such as cattle plague and pleuro-pneumonia, and also with a notable change in the methods of maintaining certain animals, particularly cattle of pedigree stock and of the dairy breeds, for intensive production. In central Europe the period of enforced under-feeding and poor maintenance represented by the War years is said to have caused serious trouble in restoring the livestock of the affected countries to normal fertility. Paradoxically, for an apparently opposite reason, the dairy cattle of countries, like Denmark, which are systematically fed with rich food and kept indoors in comfort to yield abundant milk throughout the year also suffer from serious endometritis and resulting sterility.

During this period of thirty years, there have flourished certain schools of veterinary thought which have advocated different methods of treatment based upon the particular views or assumptions they have favoured in regard to the origin of multiple sterility commonly among animals:—

(*a*) *The infectious vaginitis school.*—If we accept McFadyean's criticism (1926) [3], the part taken by a number of veterinary writers on the Continent of Europe in giving wide publicity to the alleged significance as the common cause of bovine sterility, of what they wrongly believed to be an abnormality on the membrane of

the posterior vaginal vestibule, represents one of the most discreditable chapters in recent veterinary history. The condition was first described, it seems, by a Swiss veterinarian, Isepponi, in 1886, and during the succeeding years it became widely recognized by the foremost veterinary writers as the cause of both sterility and abortion in cattle, and the most drastic remedies were applied in treatment. Bang's (1897) discovery of the bacterial agent which is the common cause of infectious abortion in cattle then eliminated the vaginal condition as a factor in abortion. In 1901, Ostertag [4], however, studied the condition in the laboratory, mainly upon one heifer which was sent to him stated to be suffering from the typical disease, and produced evidence to show that it was caused by a specific streptococcus. Other workers then quickly furnished ample corroboration to Ostertag's findings. It is interesting now to read in his original article that Ostertag's heifer, which was killed after providing him with material for his experiments for three months in the laboratory, was found on slaughter to be in a state of normal pregnancy, of about four months' duration. The teachings inculcated among cattle owners by the infectious vaginitis school, however, have died hard. Although in continental writings the opinion is now universally held that the significance of this infectious vaginitis as a cause of sterility was very much exaggerated at one time, many of the surviving older writers still hold a compromising attitude in regard to it, and devote lengthy chapters to its discussion. What has passed for infectious vaginitis (*ansteckenden Scheidenkatarrh*) in German writings refers mainly, it would seem, to a nodular or granular condition on the floor of the vagina, especially marked around the clitoris—a condition which is a physiological one, especially evident during pre-œstral periods (Webster, 1932 [5]); a similar condition is also seen sometimes on the penis of bulls. Pomayer (1930) [6] thinks that in heifers particularly the condition may give rise to a sensitiveness of this region, around the clitoris, after coition, leading to intense straining and extrusion of semen. This belief, however, seems to be ill-founded (Abelein, 1930 [7]). The extraordinarily high incidence (over 80%, Williams, 1921 [8], and others) of the condition among cattle in regions where reproductive trouble is not of unusual prominence and the fact that it is no more common among herds affected with sterility than among those which are not affected are evidence against its infectious nature. More recent attempts at experimental transmission with vaginal secretion and micro-organisms isolated from the vagina have not been successful (Quinlan, Mettam and Bisschop, 1929 [9]). Diplococci (not identical with the streptococci described by Ostertag), indistinguishable from those found in the normal vagina, have been isolated from presumably affected cattle by Ispolatow (1929) [10], and although he believed the local application or intravenous inoculation of cultures of these organisms brought about an inflamed condition of the vaginal follicles he was unable to conclude that the organisms could be the primary cause of the naturally observed condition. One writer (Frei, 1926 [11]), passing over this condition rapidly in a lengthy theoretical monograph on sterility, puts forward the view that it is not impossible that the condition is really a disease set up by a virus which has greatly diminished in activity during the last thirty years. This is rather incredible. Other writers (*vide* Oppermann, 1924 [12]) take up the position that because, for some years, such pains were taken to explain to stock-owners the nature and significance of the condition, a midway position ought now to be adopted. There is no doubt but that there are one or more morbid conditions affecting the bovine vagina, which are usually venereally transmitted, are generally mild and transient in character, but may sometimes give rise to serious localized outbreaks of metritis and sterility, and sometimes early abortion. These will be discussed later. It is evident, however, that these conditions do not embrace the widespread nodular condition which, it now seems, is a normal appearance, in spite of the mass of testimony in standard German and other works (such as Williams's textbook) incriminating it as a morbid process. Webster (1932)

[5] is probably right when he says that the frequent association of this condition with sterility is due to the neglect of the earlier observers to study sufficiently herds that were unaffected by sterility and other breeding diseases.

(*b*) *The Swiss School.*—The teachings, notably of Zschokke (1900) and Hess (1905), laid it down that the primary seat of abnormalities in the genital tract (of the female, for the male was regarded as of minor significance in sterility) was the ovaries. In sterile cows, cysts could be discovered clinically in a very large proportion on manual examination, and forcible rupture of the cysts brought about the reappearance of œstrum. Hess, further claimed that ovarian cysts were associated with the presence of the infectious vaginitis, now believed, as stated above, to be erroneously described as such. Following upon these earlier teachings, the significance of ovarian abnormalities, such as (i) retention cysts, in the follicles with resulting nymphomania, or in the corpora lutea with irregular œstrum, and (ii) persistent corpora lutea, with suppression of œstrum, have become better understood, and the teachings of the Swiss school, although they are not widely upheld now among veterinarians outside Switzerland, served a useful purpose in directing attention to the sex glands. Treatment based upon these views regarding ovarian trouble undoubtedly frequently led to restoration of normal œstrum, followed by conception. It now seems, however, that the very high incidence of ovarian cysts reported by Hess often referred to large Graafian follicles normally reaching maturity.

(*c*) *The Danish School.*—Having failed to achieve satisfactory results in practice from the application of the Swiss method of treatment for sterility, Albrechtsen, a veterinary practitioner at Bornholm, was impressed by the findings of Tuff, working in Bang's laboratory, upon the lesions in the genital tract of cattle affected with sterility, and came to the conclusion (1906) that this condition was primarily the result of an endometritis. The results were communicated to the International Veterinary Congress, at The Hague, in 1909, and thereafter gained a wide publicity. This was followed by the publication of his monograph on sterility in cattle [13], which has been regarded by many as the basis of modern rational attempts at treatment of the condition. Sterility in mares was also shown to be characterized by the frequent presence of an endometritis; it was claimed to yield likewise to operative treatment and irrigation aimed at destroying infection within the uterus. Although Albrechtsen's method marked an undoubted step forward, in locating the most common seat of lesions in sterile females, it must now be admitted that the rationale of the treatment did not amount to much more than what, in parallel fashion, could be said if in an inefficient troop of horses the diagnosis was made of sore-backs and the treatment recommended was nothing but thorough disinfection of the sores. It is a striking commentary upon the efficacy of the treatment advocated by Albrechtsen that one of his most ardent disciples, F. Nielsen (1926) [14], in outlining the measures to be adopted in dealing with the various grades of endometritis, recommends, in the case of the most severe, namely, pyometra, that treatment should begin by dislodgment of persistent corpora lutea, a manipulation which brings about, so he records, rapid contraction of the uterus and evacuation of the contained pus, followed often by œstrum. The Swedish authority, Stålfors (1930) [15] proceeds to treat by a combination of both the Swiss and Danish methods, but admits that in the opinion of some competent Swedish veterinarians, irrigation merely of the vagina, with a varied assortment of medicaments—some use methylated spirits—is often sufficient to bring about uterine contraction, return of œstrum, and successful conception. He himself claims ovarian implantation to succeed when the above measures fail. The defect in the Albrechtsen viewpoint is that the endometritis is taken as an accomplished fact in sterility, and therapeutic treatment, as a sufficient intervention, is directed at this fact, without persevering inquiry further into the ultimate origins of the observed endometritis. The Albrechtsen findings have been abundantly confirmed in so far as histological changes in the endometrium

can be demonstrated in cases in which the sterile animals show clinically even mild or merely transient periodic catarrhal discharge (Richter, 1926 [16]; Quinlan, 1928 [17]). In such cases, however, as has been shown by Götze (1930) [18], bacteria are often very rare in or even altogether absent from the discharge. As will be shown later, in the most severe cases, where there is heavy infection, the bacterial flora often consists of organisms which cannot well be classed as other than banal organisms, which have gained entrance into the functionally depressed uterus from the vulvo-vaginal vestibule.

(*d*) *The Williams U.S.A. School.*—Although his bacteriology seems to be erroneous at almost every point, Professor W. L. Williams, of the New York State Veterinary College, Cornell University, has harped on a theory regarding what he calls the pathology of reproduction, based on extensive obstetrical experience, which seems, in its essence, to cover best of all the facts that are now being experimentally determined by workers in the several fields that touch upon the problem of sterility. His views have obtained a wide currency among veterinary practitioners, and in Germany there is a section of laboratory workers (Beller [19], Wagner [20]) which adheres to his teachings. In so far as this school maintains that the normal gravid uterus harbours a bacterial flora, which is in a latent state of activity, its views have been vigorously contested (Klimmer, Haupt and Roots, 1928 [21]), and from the careful researches of Fitch and Bishop (1932) [22] it seems that, as was to be expected from observations on the human subject, these views were the outcome of faulty technique. The observations of Lütje (1924) [23] upon foaling mares have shown that the uterus is sterile except for a few days following upon parturition and that the uterine secretions normally possess a powerful bactericidal effect. Again, in assuming that the common cause of bovine contagious abortion, *Brucella abortus*, is to be regarded in the same light as the vestibular flora which, in certain conditions, may become raised to pathogenic status, the views of this school are probably not wholly in harmony with the recorded findings of the bacteriologists. And, Professor Williams [24] seems to have altogether misunderstood the meaning of the Committee of the National Veterinary Medical Association in America when it recommended that bulls infected with *Brucella abortus*, as disclosed by the agglutination test, could be used for service, because they were not capable of transmitting the infection during service. This recommendation, based on good experimental evidence, did not mean, as Williams concludes, that the Committee recommended the use of unsound bulls as stockgetters. On the other hand, the principles which Williams [25] lays down in the summary given at the close of his recently published lectures (1932), while giving no flagrant offence against the codes of orthodox bacteriology, embody a number of statements which seem to be in harmony with the findings of the several kinds of specialist workers upon the phenomena of reproduction. He maintains that no stage in the life history of the individual is free from danger to the function of reproduction, and to obtain the highest degree of fertility, the newborn animal, of either sex, must be kept in the highest state of health during the developmental period of its reproductive system. Certain points in the breeding life are especially vulnerable, notably, the young animal should not be put to the strain of early breeding, and the significance of bad food, inclement weather, and other "stresses" should be kept in mind. Bad sexual hygiene, of the kind indicated, is the primary cause of sterility; infection is ever-present, but its rôle is secondary. The lowered resistance to infection may be transmitted to the succeeding generation.

The Incidence, Nature and Significance of Infection in the Genital Tract of Sterile Animals, viz., (I) Equine, and (II) Bovine.

Having reviewed the statements regarding the causation of sterility contained in a rather abundant and growing literature, we shall now proceed by analysis of some findings recorded by workers in different parts of the world, upon animals maintained in different conditions, to ascertain the part played by infectious disease. The effects

produced by extensive epizootics of certain diseases, such as foot-and-mouth disease, which are well known to be followed by decreased fertility, are worthy of mention: infertility of this kind does not belong to the class which ordinarily exercises the veterinary practitioner. The recorded facts[1] selected for analysis are displayed in tabular form.

(I) Equine Sterility.

In the equine species, a very high percentage of sterility is said to be associated with endometritis in the female—for example, Oppermann (1924) [12] states, from the findings of various German workers, that about 70% at least, and Robin (1929) [1] thinks that in France about 95% of sterile mares have endometritis. It is not held with any degree of insistence, as in the case of cattle, that the sterility is a sequel of infectious abortion. In France, Robin mentions that the records kept by the Government studs show that the incidence of sterility is no higher in mares that have aborted than in those that have never aborted.

Tables 1 and 2 show, respectively, the figures obtained regarding the incidence of bacterial infection in the uterine secretions of mares in the Government Stud at Stade, Germany (Lütje, 1924) [23], and in the dense horse-breeding area in and around Lexington, Kentucky, U.S.A. (Dimock and Edwards, 1928) [26].

Table No. 1.—Mares: Bacterial Content of Uterine Secretions.

[Lütje (1924)—Stade, Germany.]

	Conditions affecting the Mares examined			
	Abortion	Had foaled* Joint-ill Progeny	Sterility**	Parturient Laminitis
Mares, total number examined ...	378	206	4,304	22
B. abortus equi	140	22	12	8
B. coli	14	10	2	10
Diplo-streptococci	19	19	4	4
B. viscosum equi	7	5	0	0
Negative	208	157	4,286	0

* Material taken within 3 weeks of birth of foal. ** All barren for a year or longer.

Table No. 2.—Mares: Bacterial Content of Uterine Secretions.

[Dimock and Edwards (1928)—Kentucky, U.S.A.]

		Number
A.	Mares examined	4,000 (approximately)
	,, proved barren...	1,606
B.	Barren mares: (*a*) Not infected	1,019 (63%)
	(*b*) Infected	587 (37%)
C.	Infections: *Streptococcus genitalium* (? *epidemicus*)	390 (67%)
	Encapsulatus genitalium (? *B. viscosum equi*) ...	60 (10%)
	Miscellaneous infections	137 (23%)
D.	Mares foaled normally examined (1-9 days *post partum*) ...	40
	Found infected	23 (57%)
	Comprising:—	
	Streptococci	16
	Miscellaneous organisms	7

At first sight, the German and Kentucky figures show considerable disparity. Whereas in the German figures less than one-half per cent. of the barren mares disclosed a bacterial flora, in the Kentucky figures 37% showed recognizable infection in the uterine secretions. The figures given by Lütje for mares that were examined for reasons other than sterility are inserted for comparison. It will be noted that in the few cases of sterility in which the presence of infection could be demonstrated the bacteria isolated belonged to the same range of species as were found in the mares examined for the other conditions. He notes that the normal vaginal flora of the mare also contains coliform organisms and diplo-streptococci of varying degrees of

[1] In the spoken address these were given in the form of a series of tables thrown on the lantern screen.

virulence. The condition of parturient laminitis, in all cases of which bacteria were isolated from the uterine secretions, could be treated successfully by uterine irrigation, so that acute infection with the different organisms named is not necessarily followed by any permanent ill-effect. Lütje thinks that the bacterial infection of the endometrium may possibly be a fleeting one, leaving the tissue in what he calls a bacteria-free, histologically deranged condition, so that at the time when the mares were examined for their barrenness, i.e., after an interval of at least a year after the last normal foaling, no bacteria could be isolated from the uterine secretions. The proportion of cases which were found negative among the mares which had aborted was very high (55%), and workers elsewhere on equine abortion might be tempted to think that not all cases of uterine infection were detected by the methods employed. The names given to the bacteria isolated have been translated into the designations usually given to them in this country.

Among the Kentucky mares, bacterial species are listed under names which appear unfamiliar to European workers. The *Streptococcus genitalium* is probably, however, identical with one of the two types of diplo-streptococci briefly described by Lütje in the uterine secretions of the German mares, namely, Adsersen's Type I "Joint-ill" streptococcus, the other type being Adsersen's Type II "Strangles" streptococcus (*Str. equi*). Again, the streptococcus isolated from the uteri of mares by Edwards and given a new specific designation by him was probably already well known in the recent literature on streptococci under the name *Str. epidemicus*. This belief is confirmed by the fact that in a very recent article Hadley and Frost (1933) [27] state that they had obtained a strain of streptococcus from Edwards which he had isolated from the genital tract of a barren mare and which they name *Str. epidemicus*. They found that this streptococcus set up a most severe type of mastitis experimentally in cows' udders identical with that produced by *Str. epidemicus* of human and bovine origin. *Str. equi*, on the other hand, did not set up a mastitis, although sometimes it secured a foothold in the udder. Both streptococci are of the β-hæmolytic type. Edwards's streptococcus was highly virulent for rabbits but not for guinea-pigs.

The organism listed as *Encapsulatus* (*Klebsiella*) *genitalium* would also seem unfamiliar to European workers if it were not that the detailed description of its properties, particularly the stringy nature of the uterine exudates when infected by it and the mucoid character of artificial cultures, is strongly reminiscent of the organism well known to recent workers on joint-ill in foals as *B. viscosum equi* (or *pyosepticus* or *nephritidis equi*). On searching further into the recorded descriptions of *B. viscosum equi*, it becomes apparent that this organism may be, like Edwards's [28] *E. genitalium*, a member of the Friedländer group of bacilli. The rapidity of the fatal pyæmia in new-born foals, resulting usually in death within twenty-four hours to three days, set up by *B. viscosum equi*, is paralleled by the rapid termination of cases of pneumonia in the human subjects caused by the Friedländer bacilli. *B. viscosum equi* as a cause of joint-ill is not familiar to American workers; Udall, Fincher and Gibbons (1929) [29] record the first case of infection in a foal with this organism outside Kentucky. The suspicion that *B. viscosum equi* may be identical with Edwards's organism is strengthened by a statement made by Abel (1929) [30] in his chapter on the Encapsulated Bacilli in the latest edition of Kolle, Kraus and Uhlenhuth's handbook: "whether the causal organism of joint-ill (*Fohlenseuche*) known as *Bact. viscosum equi* belongs to the group of encapsulated bacilli must be held to be undecided." Dimock and Edwards showed that this infection could be venereally transmitted. Bacilli of this group have been recorded as the cause of metritic troubles in the human subject.

A large proportion of the Kentucky infections are grouped as "miscellaneous." Further, from the uteri of mares that had foaled normally there were recovered, in a very large proportion, streptococci resembling those isolated from the barren mares,

besides unspecified miscellaneous organisms, and streptococci of the same kind were found also just inside the lips of the vulva of maiden fillies and of mares in foal.

The position may be illustrated further by the following condensed summary (Table No. 3) of the findings of the last available report (1931) of the Conferences of the German Specialists [31] :—

TABLE No. 3.—STERILITY IN MARES.

Reichszentrale für die Bekämpfung der Aufzuchtkrankheiten, (Miessner and Köser, reporters). *7 und 8 Sammelbericht.* April 1, 1929, to March 31, 1931.

	Number
Cases observed	1,265
Further advance in knowledge	None
Majority of cases associated with catarrhal endometritis (dry type).	
Specific bacterial causes very seldom found responsible.	
Infections determined: (*a*) Züilchow centre	102 examined, positive 23 (*B. coli*, Salmonella, micrococci)
" " (*b*) Hanover centre	277 examined, positive 75 (= 27 per cent.) (Hæmolytic streptococci, micrococci, *B. coli*)

The evidence tends to show, in reality, that the relatively high incidence of persisting infection in the Kentucky cases need not be regarded as anything more than an invasion of the uterus with banal micro-organisms, namely, hæmolytic streptococci, such as are found both in America and in Europe in the vulvo-vaginal vestibule of normal mares, bacilli of the Friedländer group, and miscellaneous other organisms—i.e., a flora merely in excess but not different in kind from that recorded, hitherto rather inadequately, from the genital tracts of mares in Europe, and also in other parts of the world. What is rather more striking than the number in which certain bacteria could be demonstrated is the large proportion of cases of sterility in which bacteria have not been isolated from the uterine secretions.

(II) BOVINE STERILITY.

(1) THE RELATIVE IMPORTANCE OF THE MALE AS A FACTOR IN STERILITY.

Most writers on the subject of sterility in cattle assert that the male plays a very small or negligible part in this problem. Apart from cases of temporary infertility or subfertility due to genetic or functional causes, of the kind already mentioned by previous speakers, and of specific venereal infection of the kind to be mentioned later, there are on record, however, many instances of complete or permanent infertility in the male. Perhaps the most complete inquiry hitherto reported is that of Richter (1932) [32] summarized in Table No. 4 below.

TABLE No. 4.—STERILITY IN BULLS.

[Richter, 1932, Saxony.]

		Number
Bulls examined during 4 years (1927-1931)		2,185
Bulls found sterile...		14 (i.e., 1 in 150)
Causes of sterility in above 14 bulls	1.—Congenital deformities (displaced sigmoid flexure of penis) (*Impotentia coeundi*)	2
	2.—Acquired defects. (Mainly *Impotentia generandi*)	12
	(*a*) Testicular atrophy (viz., Generalized scabies, 2; and testicular fibrosis of unknown ætiology, 2)	4
	(*b*) Tuberculosis of testicles and epididymis	3
	(*c*) Pseudo-tuberculosis	1
	(*d*) *Brucella abortus* orchitis	4

These bulls belonged mainly to peasant farmers in Saxony and neighbouring States. It will be seen that infection with tubercle bacilli and with the common causal organism of contagious abortion account, for one-half of the cases of permanent sterility in bulls. The condition described as pseudo-tuberculosis has been seen often in the testicles of slaughter-house bulls in this country, and is of unknown ætiology. The significance of *Brucella abortus* infection in the bull has

been explored a good deal by American workers, who, on the whole, think that it is of little importance, though sometimes well-marked lesions in the genital organs may be produced by it. In Richter's cases the infection set up a very marked orchitis with swelling of the testicles. An interesting inquiry has recently been carried out by King (1932) [33] in Australia into this problem; his results are summarized below (Table No. 5):—

TABLE No. 5.—ORCHITIS IN BULLS INFECTED WITH *Brucella abortus*.

[King, Australia, 1932.]

	Number
Bulls tested (by agglutination test)	104
Found positive	10
Suspicious	8*
Negative	86

* Two later proved positive.

Among the 10 reacting bulls, orchitis could be recognized clinically in 4; the presence of infection was confirmed in one bull on P.M. examination, by the discovery of specific lesions and isolation of *Br. abortus* in culture.

King's figures show that *Br. abortus* infection may sometimes bring about unexpected troubles when it is introduced into a herd by causing clinical orchitis, which is likely to be followed by permanent sterility, in the herd bull or bulls.

This phenomenon may account for some of the recorded sterility observed in herds shortly after contagious abortion has appeared or after vaccination of a herd by inoculation with the live *Br. abortus*.

(2) STERILITY IN COWS.

(*A*) On account of its prevalence and economic importance the study of sterility has of recent years attracted more attention, as it affects the bovine female more than any other kind of domesticated animal. The problem in the cow may be conveniently examined under the headings of classification adopted by Quinlan (1928) [17] in the introduction to his published report upon an extensive study of this subject, with an exhaustive review of the literature, undertaken by him in South Africa:—

STERILITY IN CATTLE.

Causes.

[Quinlan, South Africa, 1929].

A. Temporary. *B. Permanent.*

Subdivisions:

I. Infectious sterility, caused by
   (*a*) Tuberculosis,
   (*b*) Contagious abortion,
   (*c*) Contagious granular vaginitis,
   (*d*) Non-specific infections.

Diseases produced by these infections:—
   1. Cervicitis.
   2. Metritis.
   3. Salpingitis.
   4. Cystic degeneration of the ovaries,
      (i) Graafian follicle.
      (ii) Corpus luteum.
   5. Retained corpus luteum.

II. Non-infectious sterility:
   (*A*) Functional sterility;
   (*B*) Congenital and acquired deformities of the genital tract.

The method of classification well reflects the views held by competent veterinary workers until recently upon the rôle of infection.

The problem of infectious sterility in the bovine female may again be further reviewed, perhaps better than by quoting from the extensive literature extant on the subject, by noting some of Quinlan's main findings:—

The importance of infectious vaginitis has been very much exaggerated.

In South Africa, cervicitis is very common in some herds.

Chronic endometritis is undoubtedly the cause of sterility in 70-80% of sterile cows (over 4,000 examined).

Tuberculous metritis was found in 18% of tuberculous cows examined post mortem in these investigations (a higher percentage has been given by some other workers).

(*B*) CERVICITIS AND ENDOMETRITIS IN THE COW: COMPARATIVE INCIDENCE AND SEVERITY AMONG HERDS OF CATTLE IN: (1) DENMARK, (2) SAXONY, AND (3) NEW ZEALAND.

The following tabular statements have been extracted from the recent publications of Folmer Nielsen (1926) [14], Richter (1926) [16], and Webster (1932) [5]. Although the method of examination varies considerably in the hands of the different workers the information provided gives a very fair indication of the seats of the lesions and their degree of severity in the genital tracts of cows as revealed by modern methods of examination. Richter's results are particularly significant because his subjects were carefully selected and subjected to a minute clinical and *post-mortem* examination.

TABLE NO. 6.—STERILITY AND ABORTION IN COWS.

Denmark. [Folmer Nielsen, 1926.]

1.	Herds, number examined	10
2.	Period of examination	18 to 41 months
3.	Cows, total number under examination	1,542
4.	Observed pregnancies in above cows	2,607
	Comprising:	
	(A) Full term births	2,236 (85·8%)
	(B) Abortions	371 (14·2%)
5.	Cows cast for sterility (permanently barren), total number ... i.e., about 1 in 15 each year (in spite of treatment)	233 (15·1%)

		(A) Cows that had calved normally [=2,236 pregnancies, 85·8%]		(B) Cows that had aborted [=371 pregnancies, 14·2%]	
		Percentage of above		Percentage of above	
6. Further History of above cows	Normal	37	...	16·4	
	Retained afterbirth	5·8	...	14·0	
	Endometritis puerperalis	1·9	...	8·4	
	Endometritis chronica:				
	I. Catarrhalis	32·8	...	38·5	
	II. Fluor albus	9·2	...	15·9	
	III. Pyometra	0·5	...	2·4	
	IV. Advanced, asthenic, with ovarian cysts	4·9	...	5·4	
	Parametritis	1·1	...	1·1	
	Conceived again	66·2	...	60·4	

"Sterility caused primarily by ovarial ailments is rare in comparison with sterility, the primary cause of which is located in other parts of the genital organs."

"Albrechtsen's great merit is that he was the first one to call attention to the overwhelming importance of chronic endometritis as a cause of sterility."

TABLE No. 7.—STERILITY IN COWS.

Saxony. [Richter, 1926.]

		Number
	Barren cows examined (both clinically and *post mortem*, macroscopically and histologically)	203
Lesions found in genital organs	1. Vagina (congenital deformities, etc.)	10 (5%)
	2. Cervix (cervicitis), including 20 (10%) with marked swelling and polypi ...	54 (27%)
	3. Uterus—endometritis chronica	107 (53%)
	Comprising :—	
	I. Endometritis catarrhalis chronica	53 (26%)
	II. Endometritis catarrhalis et purulenta chronica	36 (18%)
	III. Fluor albus	17 (8%)
	IV. Pyometra	1 (0·5%)
	(Of 49 cases of I and II specially examined, 6 were endometritis tuberculosa)	
	4. Fallopian tubes :—	
	Salpingitis tuberculosa...	3 (1·5%)
	? Salpingitis catarrhalis	8 (4%)
	5. Ovaries :—	
	Atrophy, etc.	4 (2%)
	Starvation sterility	16 (8%)
	Obesity	0
	Corpus luteum persistens (viz. 24 alone, and 11 with endometritis) ...	35 (17%)
	Ovarian cysts	11 (5%)

TABLE No. 8.—STERILITY IN COWS.

New Zealand. [Webster, 1932.]

		Number
	Barren cows examined *post mortem*	315
	(In New Zealand most cows classed as "barren" will hold to first service if kept over the winter to the following spring).	
Lesions found in genital organs	I. No lesions	46 (14·6%)
	II. Abnormal ovaries	128 (40·6%)
	(Including cystic corpora lutea)	98 (31·1%)
	III. (*a*) Cervicitis	180 (57·1%)
	(*b*) Metritis	17 (5·4%)
	(*c*) Salpingitis	4 (1·3%)

NOTE.—Breeding commences in November (i.e., early summer) with the object of getting the cows to calve early in the following spring.

The following points stand out upon examination of the results recorded in the different countries :—

(*a*) In F. Nielsen's ten herds in Denmark the incidence of uterine disease was very high, only 37% of those cows that calved normally having a subsequent normal reproductive history, and only 16·4% of those that had aborted. 66·2% only of the cows in the former (normal) class and 60·4% of those in the latter (aborted) came into œstrum and conceived again. The high percentage of metritic troubles were of varying degrees of severity, as shown in the table, the classification of the various degrees corresponding approximately with that adopted by Richter.

(*b*) If we assume thus that the classification adopted by the two authors corresponds, the incidence of the more severe types of endometritis (*fluor albus* and pyometra) is even higher in the Danish herds than in cows selected for detailed examination by Richter in Saxony because of persistent sterility.

(*c*) In New Zealand the incidence of all grades of metritis among cows "culled" for sterility is very low relatively, the inflammatory process being restricted to the cervix in the majority of animals.

The conditions of maintenance of the cows in the three countries are, so far as can be gathered :—

(*a*) Denmark. Indoors most of the year; fed on concentrated foodstuffs for high milk production throughout the year.

(*b*) Saxony. Belonged to rather poor peasant proprietors; often underfed (cases of ovarian trouble, due to underfeeding, reported; none due to overfeeding); breeding apparently mainly during the natural season, out-of-doors.

(*c*) New Zealand. Out-of-doors. Pasture-fed. Breeding arranged to take place, so that the cows calved always at the commencement of the season of luxuriant vegetation.

(C) Salpingitis in the Cow and Mare.

Disease of the oviducts, or Fallopian tubes, is regarded as almost the most common cause of permanent sterility in the human female. The condition is determined, mainly, by gonorrhœal and, next, by tuberculous infection. In the cow a large importance has been given to disease of the tubes by certain workers—Williams, 1921 [8], in U.S.A; Oppermann, 1923 [12, 34], in Germany. Quinlan, 1929 [17], has recently published a minute description of the condition. The following figures (Table No. 9) summarize a study undertaken by Richter and his colleagues, 1927 [35], comprising a detailed histological examination in each case, of the oviducts in slaughtered cows and mares:—

Table No. 9.—Sterility in Cows and Mares.

(Saxony), Richter, Roth and Kokkonen, 1927: Disease in the Fallopian tubes.

		Number
A. Cows (former history partly known only)	Examined *post mortem*, histologically, total	100
	I. Congenital, anatomical defects ... ... (Cysts, stenosis, membranous septa, etc.)	8
	II. Acquired defects:	
	(*a*) Salpingitis tuberculosa ... ... (With T.B. of ovaries, 11; with T.B. of uterus, 14)	20
	Note. — Descending infection, i.e., of peritoneal (not hæmatogenous) origin	
	(*b*) Salpingitis non-tuberculosa ... ... (Included only one case which could have been detected macroscopically)	13
	(These 100 cases comprised 11 with ovarian cysts; of these 11, 8 showed disease of uterus and 10 showed disease of Fallopian tubes)	
B. Mares (former history unknown)	Examined *post mortem*, histologically, total ... ... (Including 68 over 15 years of age)	100*
	I. Congenital, anatomical defects ... ... (Including 16 with cysts in mesosalpinx)	17
	II. Acquired defects:	
	Salpingitis	0

* 9 showed macroscopically visible metritis. Difference in incidence of salpingitis in mare and cow may be explained by different anatomical relationships at cornual orifice.

In the cows the figures reveal a surprisingly high incidence of tuberculosis in the tubes. The tuberculous infection was of a descending character, that is, it appeared to spread down the tubes by extension from the peritoneal cavity, and differed in this respect from tuberculous salpingitis in the human subject, which is considered to be usually of hæmatogenous origin. The figures also reveal a high incidence of non-tuberculous ascending disease in the tubes, which could for the most part only have been detected by histological examination; in all these cases there were retention cysts in the ovaries, which would lend confirmation to the view now generally held that these structures were secondary in origin to obstruction in the genital tract.

In the mares, on the contrary, disease in the oviducts, apart from anatomical, mainly cystic, abnormalities, was not discovered, even though the mares examined were largely old animals past the normal breeding age, and among them there were nine cases in which there was macroscopically evident inflammatory disease of the uterus. The rarity of salpingitis in the mare is also confirmed by the statements of Dimock and Edwards (1928) [26]; out of 83 barren mares examined by them *post mortem*, most of which had bacterial infection in the uterus, only 18 showed evidence of salpingitis, and, in these cases, bacterial infection could not always be found.

Richter and his colleagues attribute the difference in prevalence of salpingitis in the cow and mare to the different anatomical relationships at the cornual orifices of the tubes in the two species. In the cow the cornual apex of the *cavum uteri* is continued funnel-shaped into the lumen of the tube on each side. In the mare the lower end of the tube projects into each horn in the form of a tap-like prominence,

surrounded by a thick band of unstriped muscle, which may act as a sphincter and arrest the passage upwards of uterine infection.

The bacterial species, isolated by American and other workers, from the cases of bovine non-tuberculous salpingitis have been varied, comprising mainly in cases with distinct inflammatory lesions of the mucous membrane, streptococci (of the *a*-hæmolytic or *viridans* type) and corynebacteria (*B. pyogenes*). An Italian worker, Rivabella, 1932 [36], who has recently reviewed the literature on the subject and investigated macroscopically and bacteriologically the uteri and oviducts of forty-five cows that had been cast for slaughter mainly because of sterility, found that 35% of the tubes were infected with bacteria in these cases—a percentage which is rather lower than that given by some other workers. In one of his cases, an eight-year-old cow, the genital tract was apparently normal and the body of the uterus bacteriologically sterile, while the tubes disclosed a pure culture of a Salmonella of the Breslau type.

(D) The Relationship between Contagious Abortion and Sterility in the Cow.

F. Nielsen (1926) [14] has expressed a view which is probably in accord with the experience of most clinical observers: he says that when contagious abortion first severely affects a herd of cattle, abortions take place mostly during the earlier stages of pregnancy from about four months onwards, and the incidence of disturbed œstrum and sterility afterwards is low. Subsequently, when the disease has run its course for some time, abortions are fewer and occur later in pregnancy, but are accompanied by a large incidence of premature births, retained placentas, severe endometritis, and sterility. A table (No. 6) has already been given summarizing some of Nielsen's observations; from it, it will be seen that although the sequelæ mentioned are undoubtedly more common in the group of cows that had aborted than in the group that had calved normally, the difference in the groups seems to be merely one of degree of severity, for in the normal group only 66·2% again became pregnant as against 60% in the abortion group. It is likely, however, that a large proportion of the cows in the normal group were specifically infected, with *Br. abortus*, even though they had a history of normal calving. Hence, from observations of this kind it is difficult to estimate what rôle infection with *Br. abortus* plays as a cause or forerunner of bovine sterility. To determine this rôle more clearly it would be necessary to separate, upon the evidence of frequently repeated serum testing, a herd of cattle into two groups, namely, (*a*) reactors, and (*b*) non-reactors to the test, and note the subsequent breeding history of the two groups while they were kept in segregation and served by the same bull or bulls. Fortunately, there are now available in the literature two sets of observations of this kind, namely, one by Lothe (1929) [37], of Wisconsin, and another by Webster (1932) [5], of New Zealand. These results are summarized in the following Tables, Nos. 10 and 11.

Table No. 10.—Sterility in Cows: Relationship to *Br. abortus* Infection.

"Reproductive efficiency" (Annual pregnancies) among (A) Non-reactors, and (B) Reactors to *Br. abortus* Bang infection in a herd of, altogether, 269 cows observed over five years (Lothe, 1929, Wisconsin, U.S.A.).

	Total	Aborted	Still-births	Premature births
Reactors	60	20 (33%)	7 (12%)	32 (53%)
Non-reactors	209	29 (14%)	4 (2%)	45 (21%)

"*Reproductive Efficiency.*"

Year	Reactors	Non-reactors
	%	%
1923 ...	73 ...	85
1924 ...	54 ...	64
1925 ...	49 ...	47
1926 ...	47 ...	62
1927 ...	32 ...	63

Note.—**The detailed history of the herd strongly suggested a prevailing infection other than *Br. abortus* infection which was venereally transmitted by three bulls used.**

TABLE No. 11.—STERILITY IN COWS: RELATIONSHIP TO *Br. abortus* INFECTION.

"Breeding-efficiency index" (i.e., number of services required for each pregnancy) among (A) Non-reactors, and (B) Reactors to *Br. abortus* Bang infection in a herd of 61 pedigree cows (Webster, 1932, New Zealand).

	Total	Calving record.			Subsequent breeding record: Held to services.					"Breeding Efficiency Index" (in Fertile Cows).
		Normal	Aborted	Barren	1st	2nd	3rd	8th	Remained barren	
Reactors ...	40	12	20	8*	13	13	4	1	10* (25%)	1·9
Non-reactors ...	21	18	1	2†	15	2	3	0	3† (13%)	1·4

* 7 out of the 10 had lesions of ovaries, oviducts, or endometrium (diagnosed clinically).
† 2 out of the 3 had salpingitis (diagnosed clinically).

The results given in these tables show that in both herds fertility was much decreased in the cows that were proved to harbour *Br. abortus* infection. Nevertheless, in the cows that were free of this infection there was also a marked percentage of sterility and other breeding trouble, *including some abortion*. The effect of the *Br. abortus* infection in each herd would therefore seem to be to aggravate some other concurrent infection which was prevailing in the herd. In Lothe's herd, the detailed breeding history of the animals seemed to suggest that this concurrent infection was venereally transmitted by three bulls used. The record given by Webster is, he states, an exceptionally bad one for New Zealand, but the herd was selected as a suitable one in which to investigate the effects of *Br. abortus* upon the breeding efficiency. In his paper (as noted here later) he also provides evidence of cervicitis, caused by streptococci, being transmitted venereally by bulls to cows.

The reports obtained occasionally of outbreaks of sterility in herds after the introduction of *Br. abortus* infection which is benign in effect, or not followed by serious clinical abortion, and after vaccination with cultures of the live organism cannot be explained in the above way. This point has already been mentioned in dealing with orchitis in the bull.

(E) THE PATHOGENESIS OF BOVINE ENDOMETRITIS.

It now remains to review the evidence upon the nature of the infection in these inflammations of the female genital tract, namely, cervicitis, endometritis, and salpingitis, apart from those which are of tuberculous origin or may be classed strictly as specific venereally transmitted infections. The rôle of *Br. abortus* infection is now well understood, following the well-known researches of Schrœder and Cotton, Smith and Little, O. Bang, and others. It cannot survive more than a few weeks in the non-gravid uterus, and it produces merely superficial lesions on the chorion and maternal cotyledons. In default of secondary bacterial invaders, the lesions would quickly heal up. Besides, troubles such as retained placenta, endometritis and sterility may be seen commonly, as has been shown in the foregoing tables, in cows that belong to infected herds but have never aborted or in cows that belong to "clean" herds, that are not infected with contagious abortion. The sequence of the pathological changes in the uterus of the cow that may arise after abortion or apparently normal parturition has been clearly outlined by Sven Wall (1914) [38] as the result of a minute histological and bacteriological examination of material in C. O. Jensen's laboratory at Copenhagen. The successive stages, according to him, may be summarized in a general way as follows:—

Sterility in cows.—Pathogenesis of endometritis, either following upon *Br. abortus* infection or occurring independently. (After Sven Wall, 1914.)

Sequence of bacterial invasions and pathological changes:—

(1) *Br. abortus* infection causing, as a rule, merely superficial alterations;

(2) Pure streptococcus infection;

(3) Streptococcus infection with other bacteria, with the exception of corynebacteria (*B. pyogenes*);

(4) Pure *B. pyogenes* infection;
(5) *B. pyogenes* in combination with other bacteria;
(6) *Streptococcus pyogenes* infection, namely, the most invasive infection.

Note.—(*a*) All these infections alter the uterus, which so long as the alterations proceed, is sterile.

(*b*) After final healing, the uterus is often totally unfit for conception in consequence of atrophy, sclerosis and "ectodermoiserung" (i.e., stratification or cornification of the endometrium).

The view that the uterus when it has undergone extensive destruction of epithelium with parchment-like healing of the surface is totally unfit for the developing embryo is also supported by Williams (1929) [39]. A few other workers (Hallman, 1924 [40] and others) believe, however, that the endometrium has considerable power of regeneration and may not be impaired functionally by rather extensive destruction of the intercotyledonary epithelium.

Hallman's view is that in cases of retained placenta whether retention of the fœtal membranes follows acute or chronic inflammation of the maternal placenta, the result is the same; the larger chorionic villi cannot be forced out of the crypts. The softening of the placenta through the action of proteolytic enzymes ultimately allows the chorion to come away. This sub-involution produces a condition in the uterus which particularly favours the invasion of the tissues by pathogenic bacteria.

It has already been mentioned in the introduction that the milder forms of uterine catarrh may not harbour any bacterial flora (Götze, 1930 [18]) in the uterine secretion. Streptococci, of the *viridans* or *α*-hæmolytic type, such as are found most commonly in cases of bovine endometritis, can be readily recovered from the normal vulvo-vaginal tract of heifers and cows, often in such abundance as to have led the earlier observers to believe that they were dealing with a specific infection. The corynebacteria (*B. pyogenes*) which are found normally in the tract have been studied by Jones and Little (1925, 1926, 1930) [41] in their investigations upon the cause of infectious cystitis and pyelonephritis in bovines; several types are found, some of which can infect the urinary tract experimentally. It is likely that the uterine invaders are of the same kind. The evidence would therefore suggest that the bacterial invaders which may be found in the uterus in the common forms of endometritis associated with sterility are merely banal inhabitants of the vulvo-vaginal vestibule, and that they can flourish in the uterine cavity only when there is defective involution of the uterus and derangement of the normal uterine epithelium, the secretions of which, in the case of the mare at least, according to Lütje [23] are so strongly bactericidal that the uterus is again bacteria-free and ready for implantation of a fertilized ovum at the normal first occurrence of œstrum in the equine species, namely, seven to nine days after parturition. When this faulty involution persists in a herd for a long time it is likely that bacteria which are ordinarily of low virulence may become enhanced in their ability to invade the uterine cavity.

(F) Venereally Transmitted Infections in the Equine and Bovine Species.

There are infectious diseases in the domesticated animals which are well known to be transmitted by coitus but are not associated ordinarily with the problem of sterility. Examples are: (1) Dourine, an equine trypanosomiasis, caused by *Trypanosoma equiperdum*. (2) Equine influenza, a disease caused by a filtrable virus; stallions may remain carriers of the virus for many years without showing signs of ill-health; severe influenza may be set up in a mare after coitus, and the disease in this animal may form the starting point of an outbreak, in which infection spreads by contact. (3) Canine infectious sarcoma or granuloma.

There are now, however, a number of well-authenticated records of the spread of disease by coitus which may result in circumscribed outbreaks of sterility and sometimes serious abortion. Examples are the following:—

(i) *Coital exanthema.*—In veterinary writings a special form of venereal disease (*Bläschenausschlag*), characterized by well-marked vesicular and pustular eruptions in the vulvo-vaginal tract of the female and similar eruptions on the glans penis of the bull, has been separated off for a long time from other suspected forms of infectious vaginitis (*ansteckenden Scheidenkatarrh*). Characteristically, this disease is highly contagious and may spread to other species of animals than cattle. It is recognized by acute swelling of the vulva, great irritation, and the appearance of large numbers of papules and ulcers inside the lips of the vulva and posterior vagina. Maiden heifers may show very severe local symptoms shortly after service. Conception frequently takes place in spite of the severity of the lesions (Webster, 1932 [5]). The symptoms are usually not so severe in the male. The disease occurs in isolated outbreaks, and as it responds fairly readily to treatment, it is not regarded as a serious trouble by stockbreeders. Recently however, severe outbreaks of the disease have been carefully reported by Reisinger (1928) [42] in Lower Austria, and Küst and Uhrig (1932) [43] in Central Germany. In these outbreaks early abortion of the fœtus, within two months after the commencement of pregnancy, was a frequent occurrence, followed by severe metritis (*fluor albus* and pyometra) in a large number of cases. Often, the severe metritis was the first sign of trouble, and it was presumed that it had followed an undetected abortion. At the earliest stages, the typical symptoms of coital exanthema could be readily recognized, followed by appearances within the vulva and vagina of what had been described earlier by German writers as *ansteckenden Scheidenkatarrh*. In many cases the animals conceived after coitus, and seemed to recover completely, and then aborted early and disclosed metritic trouble. From the discharges obtained from early stages of the disease Reisinger and Reimann (1928) [44] reproduced the disease experimentally in twelve out of fifteen attempts by introducing into the vagina filtrates that had been passed through Reichl or Chamberland L3 candles. They were able to transmit the virus by passage, filtering the discharges before each successive implantation of the virus, in two separate experiments, for three and five passages, respectively. Zwick and Gminder (1913) [45] had attempted to transmit the disease with filtrates but failed, as their technique was probably not suited for the demonstration of the virus. The clinical nature of the disease would strongly suggest that it is caused by a filtrable virus. Whether the disease which is not infrequently reported in some parts of England under the name "bull-burnt" and the form of vaginitis which, according to Robin (1919) [1] provokes disastrous consequences in the practices of some French veterinary surgeons, is of the same kind remains to be proved. Streptococci can often be readily isolated from the discharges, but in the light of Reisinger and Reimann's results they may be merely of secondary importance.

(ii) *Trichomonad infection in cattle.*—This suspected infection, which had been already reported by some veterinary workers, has recently been studied by Abelein (1930, 1932) [46] in Southern Germany. Trichomonads were detected in large numbers in the uterine contents, and some experiments appeared to show that they could be transmitted venereally by the bull. According to Wiedenauer (1930) [47], however, the protozoa described are probably merely commensals.

(iii) *Friedländer infection in equines.*—As the result of observations made upon naturally occurring cases and also of the application experimentally of bacterial cultures to the sexual organs prior to coitus, Dimock and Edwards (1928) [26] came to the conclusion that infection with *Encapsulatus* (*Klebsiella*) *genitalium* could be mechanically transmitted by the stallion during coitus, with consequent cervicitis and metritis, and sterility.

(iv) *Streptococcic infection in bovines.*—There are probably many bacterial infections in bovines which can be transmitted during coitus. It has been assumed by some writers that when the vaginal flora becomes exalted in virulence following upon persisting severe contagious abortion, frequent retained placentas, and a set of local conditions, covered perhaps somewhat vaguely by the term "bad hygiene," certain species of bacteria which normally reside in the vagina acquire a high pitch of virulence and may then be spread from cow to cow as pathogenic organisms through the agency of the herd bull. This supposition would receive support from observations such as those recorded by Lothe (referred to above). The most significant work in this direction recorded recently, however, is that of Webster (1932) [5] in New Zealand. In outbreaks of enzootic temporary sterility occurring in some herds, cervicitis was a very constant feature in the females, and from the inflamed cervix streptococci (of the α-hæmolytic or *viridans* type) could be readily isolated. Streptococci of the same type could also be isolated from the semen of the bulls employed, in addition to the diphtheroids and micrococci which are normally found in the semen. Bulls affected in this way transmitted acute cervicitis to normal cows on service, with a very low proportion of conceptions ensuing. A clean bull used to serve these cows became himself severely affected. The evidence would then show that the enzootic temporary sterility in New Zealand is caused by a catarrhal streptococcic infection of the cervix transmitted by the bull during coitus. Field experience shows that the infection clears up in the course of two to three months, whereupon most of the cows breed normally. The bull may sometimes also throw off the infection, but, when he does so, he seems to remain usually impaired in fertility.

Concluding Remarks upon the Common Causes of Multiple Sterility.

As will be noted from some of the tabulated statements given a substantial proportion of cases of sterility is associated with congenital or anatomical disease of the genital tract. The proportion, however, is not high, and does not provide justification for the adoption of a routine procedure in the treatment of sterility such as the artificial insemination of mares, which practice, as shown by Oppermann, 1924 [12], was based on faulty knowledge regarding the adjustment of the genital organs of the two sexes during the act of coition.

A large proportion of cases of sterility is associated with inflammatory disease in the genital tract; this may sometimes be revealed only, as in some cases of salpingitis, by histological examination. A considerable proportion, however, show no inflammatory lesions which can be attributed to infection; in cases of mild catarrhal discharge, which represent by far the largest proportion of the recorded cases of endometritis, the bacterial flora often cannot be held, having regard to its kind and numbers, to be of sufficient importance to be deemed responsible for the catarrhal condition. Tuberculosis, which nearly always represents an extension from lesions existing elsewhere in the body, is responsible for a considerable amount of metritis associated with permanent sterility in bovines. Infectious abortion in mares is not followed by increased sterility, but in cows it is often held to be responsible; its rôle, however, is that of a predisposing cause; it seems to aggravate the action of other bacterial agents, which may be regarded as secondary invaders but may also exercise their pathogenic action independently of an antecedent infection with the abortion organisms. The miscellaneous bacteria (*Bacillus coli* types, streptococci, Friedländer types and corynebacteria) which are most commonly associated with severe endometritis in mares and cows are probably banal organisms, normal residents in small numbers of the vulvo-vaginal tract, but not of the uterine cavity. It seems that these organisms can become exalted in virulence and thus

acquire the power to invade, and become established for a time in, the uterine cavity. Some of them may be transmitted venereally, during coitus, to cause cervicitis and temporary sterility. Whether these bacterial agents are, in general, to any extent, comparable in their action with specific pathogenic micro-organisms like those of syphilis or gonorrhœa in the human subject, or are merely invaders which obtain a foothold in parts of the genital tract, from which they are normally absent, because of defective involution of the tract (produced again by some functional disturbance, perhaps remote, and of an endocrine or nutritional origin), remains to be ascertained by further research. Meanwhile, the conclusions drawn by the reporters (Miessner and Köser, 1932 [31]) to the last Conference of the German Veterinary Specialists upon the subject of bovine sterility, given below in condensed form, are significant:—

STERILITY IN CATTLE.—SUMMARY OF FINDINGS OF THE GERMAN VETERINARY SPECIALISTS.

[*Reichszentrale für die Bekämpfung der Aufzuchtkrankheiten—7 and 8 Sammelbericht—1 April, 1929 bis 31 März, 1931.*]

(1) Number of cattle examined for sterility in above period 223,459
Including number dealt with by Institutes at 8 centres 160,357
Of these, there were cast for sterility 7,299

(2) Reported causes—all kinds and degrees of disease of the uterus, oviducts, and ovaries. For example, the Landsberg centre gives chief place to uterine affections; the Dessau centre says 80% is caused by ovarian and uterine troubles.

(3) The importance of attention to maintenance and feeding in the control of multiple sterility is now stressed.

(4) "The animal body kept in unhygienic conditions is unable to guarantee the normal functioning of the endocrine system."

(5) As indicated in the report of the preceding (fifth) Conference, organic lesions in the genital tract are not always the primary cause of sterility.

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Section of Urology.

President—HUGH LETT, C.B.E., F.R.C.S.

[*April* 27, 1933.]

Case illustrating Recent Radical Operation for Testicular Neoplasm.—C. HOPE CARLTON, M.Ch.

Patient, a man aged 30, gave a history of steady increase in size of one testicle, noticed only eight weeks previously. No other complaint.

On examination.—Testicle the size of a hen's egg; hard but not nodular. Epididymis not involved. Not tender. No urinary symptoms. Vas not involved. Nothing abnormal found on rectal examination. General health good. Wassermann and Kahn reactions negative.

Exploratory operation four days later. Testicle found to be the seat of at least six homogenous nodules varying in size from that of an acorn to that of a pea, and all associated with the tunica albuginea.

Testicle wrapped in spirit. All gowns and instruments and dressings changed; operators rewashed.

Incision extended along cord and up to costal margin. Abdomen explored on that side retroperitoneally. No secondary growths apparent on naked-eye examination. Radical operation performed; removal, in one piece, of all connective tissue on posterior abdominal wall as far as the renal vessels; cleaning of aorta and division of spermatic vessels and vas as far as their remote extremities. Patient left hospital within three weeks and is now at work again.

The growth appears to be a fibroma with a slight possibility of associated inflammation.

I should like to emphasize two points with regard to this case:—

(1) Testicular neoplasms are very seldom sarcomata, therefore spread by embolus is rare and operation is not contra-indicated, as was taught thirty years ago.

(2) I have performed this radical operation three times, and in each case the patient has walked out of the hospital within three weeks afterwards. The operation causes less anxiety than that experienced in connection with a radical excision of the breast.

Total Cystectomy for Papilloma.—J. G. YATES BELL, F.R.C.S.

History.—The patient, a man aged 27, was admitted 27.6.32 into King's College Hospital as an emergency case with severe hæmaturia; because of bleeding, pain, and clot-retention suprapubic bladder drainage was performed 5.7.32, when an enormous fungating growth was found which, on microscopical examination of a section, proved to be non-malignant.

Anæmia increased, owing to the persistent bleeding. The number of red-blood cells was reduced to only three millions, and it was decided that this bleeding could be stopped only by total cystectomy. The patient could not have borne ureteric transplantation at that time, and in any case the risk of peritonitis from the foul growth was too great. It was agreed to perform double nephrostomy, with

intratracheal anæsthesia to enable both surgeons (Mr. H. L. C. Wood and J. G. Y. Bell) to operate with the patient prone, as speed was very necessary.

Three weeks later (31.8.32) total cystectomy was performed. The blood-count at this time showed only 2½ million red cells in spite of several transfusions.

On recovery the patient was shown at the meeting of this Section in November, 1932, when the general opinion was that ureteric transplantation should be carried out at one operation, using indwelling tubes. This was done 5.12.32, and great difficulty was encountered by reason of the thickness and rigidity of the ureteric walls, which prevented a satisfactory oblique passage through the bowel. It was decided to leave the indwelling tubes in position as long as possible, but some fæcal escape was expected about the fourteenth day. The nephrostomy wounds were acting well.

On the fourteenth day fæces poured through the abdominal wound, but this lasted only three days and the wound rapidly healed. What was most alarming was the appearance at the same time of fæces from each nephrostomy wound, associated with high temperature and rigors; during this period the Kidd's tubes were still acting. After a week—the patient having been purposely kept constipated—the fæcal discharge from the nephrostomies gradually cleared up. The Kidd's tubes were removed on the twenty-first day and the nephrostomy tubes on the twenty-fourth day.

Healing continued satisfactorily; all wounds closed well, and the patient is now able to hold his urine for four hours and is looking for work. Some attacks of mild renal infection have occurred, but at gradually decreasing intervals and of diminishing severity.

Two points are worthy of emphasis in this case. Firstly, speed at operation being of great importance much benefit was derived from the co-operation of two surgeons. Secondly, the fact of the patient's recovery and relatively little disturbance of health from the presence of fæces in both kidneys is no doubt due to the previous establishment of adequate drainage from the kidneys by the nephrostomy wounds, and we offer the suggestion that in cases of thickened and rigid ureters bilateral nephrostomy should be employed as a temporary measure before transplantation, to guard against the increased risk of infection.

Inoperable Carcinoma of Prostate: Transplantation of Ureter by Coffey No. 2 Method with Catheter.—CYRIL A. R. NITCH, M.S.

W. H., male.

Left ureter transplanted by Coffey No. 2 Method with No. 20 Charrière catheter.

Death on fourteenth day from bilateral pyelonephritis.

Specimen shows successful transplant with good ureteric orifice but with surrounding irregularity suggestive of ulceration of the mucous membrane, due to local infection.

Extensive Inoperable Carcinoma of Bladder: Transplantation of Ureter by Coffey No. 3 Method.—CYRIL A. R. NITCH, M.S.

W. C., male, aged 64.

Transplantation of left ureter by Coffey's transfixion suture method. Abdomen closed without drainage.

Urine began to escape from the rectum on the fourth day; pyrexia for seven days after operation.

Death from bilateral pyelonephritis on the fourteenth day.

Specimen shows successful transplant with a remarkably good opening into the rectum and no signs of local infection.

Carcinoma of Renal Pelvis.—CYRIL A. R. NITCH, M.S.

E. J. M., aged 67, had three attacks of painless hæmaturia at intervals of two months.

Cystoscopy.—Right efflux blood-stained.

U.C.T.—Left kidney, 2·8%; right kidney, 1·3%

Pyelograms.—Right pelvis showed filling defect; left normal.

Operation (right nephrectomy).—Pelvis occupied by a papilliferous growth with a hard base, which proved on microscopical examination to be a transitional-celled carcinoma.

Carcinoma of the Base of the Bladder: (*a*) Implantation of the Ureters into the Rectum: (*b*) Complete Cystectomy.—HAROLD DODD, F.R.C.S.

These specimens are from a man aged 63, who had a carcinoma of the bladder encroaching on the left ureter and the internal meatus. For three months he had suffered from painful hæmaturia.

Cystoscopy confirmed the presence of the growth. Renal efficiency tests produced normal results after rest in bed.

By the technique described by Mr. Nitch at the meeting of this Section last year,[1] the left ureter and, three weeks later, the right ureter were successfully and uneventfully transplanted into the rectum. There was slight and short pyrexia after each stage. The patient went home for two months before the cystectomy.

On his return, he could hold urine for four hours in his rectum. Sigmoidoscopy revealed the cleanest rectum I have seen. The ureteric orifices looked like small papillomas; at first sight I thought the lower one was a papilloma of the rectum, but the appearance of a drop of urine from the tip of its centre quickly labelled it. Indigo-carmine was excreted from both in from six to seven minutes.

I performed complete cystectomy under a spinal anæsthetic (novocain) with gas and oxygen. The operation was tedious but not difficult; the patient stood it badly, and his condition soon gave cause for anxiety.

Unfortunately he died from shock on the following day.

The specimens of the kidneys, ureters and rectum show: (1) The smooth, papilloma-like ureteric orifices in the rectum. (2) That the ureters are not dilated or thickened, not even at their junction with the rectum. (3) That the pelvis of each kidney is "blushed," showing the presence of infection, which has been confirmed by microscopical examination.

Hydronephrosis in Double Kidney.—GEORGE E. NELIGAN, F.R.C.S.

Girl, aged 15. Two attacks of painless hæmaturia in three months. Urine normal except for presence of blood.

X-ray examination showed fifteen small calculi in a large left kidney.

Cystoscopy showed four ureteric orifices, with blood coming from the upper left orifice. An ascending pyelogram showed a large left hydronephrosis.

Intravenous pyelography revealed double pelves and ureters on the right side, and one normal pelvis and ureter on the left; the lower half, being the hydronephrosis, showed no secretion.

Operation.—There was a large hydronephrosis of the lower left kidney, due to an aberrant artery.

After a flap of capsule from the upper third of the hydronephrosis had been separated, the hydronephrosis was cut away by diathermy and the flap sutured over the lower part of the upper kidney.

The patient made an uninterrupted recovery.

[1] *Proceedings*, 1932, xxv, 1413 (Sect. Urol., 31).

A New Method of implanting the Ureters into the Bowel.

By H. P. WINSBURY-WHITE, F.R.C.S.

TWO important principles are involved in this method.

First, a barrier is provided against the ascent of infection from the bowel to the kidney, and secondly, the implantation is brought about without any danger to the vitality of that portion of the ureter immediately in relation to the bowel at the site of the anastomosis. All the evidence points to the fact that infection ascending to the kidney passes upwards not by way of the lumen of the ureter but in some deeper plane. It would seem therefore that to establish by grafting firm union between the bowel and the ureter, before the element of sepsis is introduced into the field of operation by opening the bowel, would be to interpose a protective fibrous tissue barrier, which should act as a safeguard against renal infection. The assurance to the vitality of the ureter comes about from the fact that the portion of this structure which is disturbed from its bed continues to receive its blood supply both from above and below.

The procedure consists of two chief stages. In the first, the ureters are dislodged from their beds in the iliac region and are grafted into the wall of the pelvic colon. Firm union is allowed to occur before the lumen of either ureter is divided or opened and without interrupting the flow of urine along the ureters into the bladder. In the second, the ureters now firmly attached to the bowel are drained into the lumen of the latter structure. The details of the technique can be followed by referring to the illustrations.

The abdomen is opened and the portion of the pelvic colon which lies just above the promontory of the sacrum is chosen for the site of the anastomosis. An incision three inches in length is made through the peritoneum in the line of the left ureter at the level of the site chosen for the implantation. The exposed portion of this structure is then gently dissected from its bed and the peritoneum re-sutured behind it. An incision one inch in length is now made along the left lateral margin of the portion of the pelvic colon which has been selected, passing through peritoneum and muscular coat. The muscular wall is separated freely from the mucosa along either margin of the incision, sufficiently to allow the cut edges to be re-sutured over the ureter without tension. This procedure is then carried out with a continuous catgut suture (fig. 1).

A fortnight later the abdomen is opened again, the left ureter is divided between clamps about three-quarters of an inch below the distal limit of its union with the bowel. The proximal portion of the divided ureter is transfixed by a catgut suture and the other is ligated. Two traction sutures are then placed through the bowel wall on either side of a line along which a longitudinal incision will be made to open into the lumen for half an inch. This cut must divide the wall of the intestine right up to the lower surface of the ureter where these two structures are adherent. The two ends of the suture which previously transfixed the upper end of the divided ureter are now each threaded with a small curved round-bodied needle. The clamped end of the ureter is next severed from the main structure and the lower border of the open duct is next divided in its long axis for one-quarter of an inch.

The open end of the ureter is now fixed within the lumen of the bowel by passing each needle in turn through the opening in the latter and transfixing the wall from within outwards below the lower limit of the cut. The suture ends are tied.

The hole in the bowel wall is then closed by a continuous through-and-through catgut thread which is reinforced by a line of Lembert sutures. The abdomen is closed with a rubber drain passing down to the site of the anastomosis.

Whether both ureters should be grafted on to the bowel at the same time was a question which I had to approach cautiously, as there was no previous experience

of this operation to guide me. I grafted each ureter separately. This involved opening the abdomen on three separate occasions.

The case with which I dealt was in a girl aged 13 who had hypospadias and complete incontinence of urine. At the first operation I opened the abdomen and grafted the left ureter on to the bowel wall. On the second occasion I inserted the

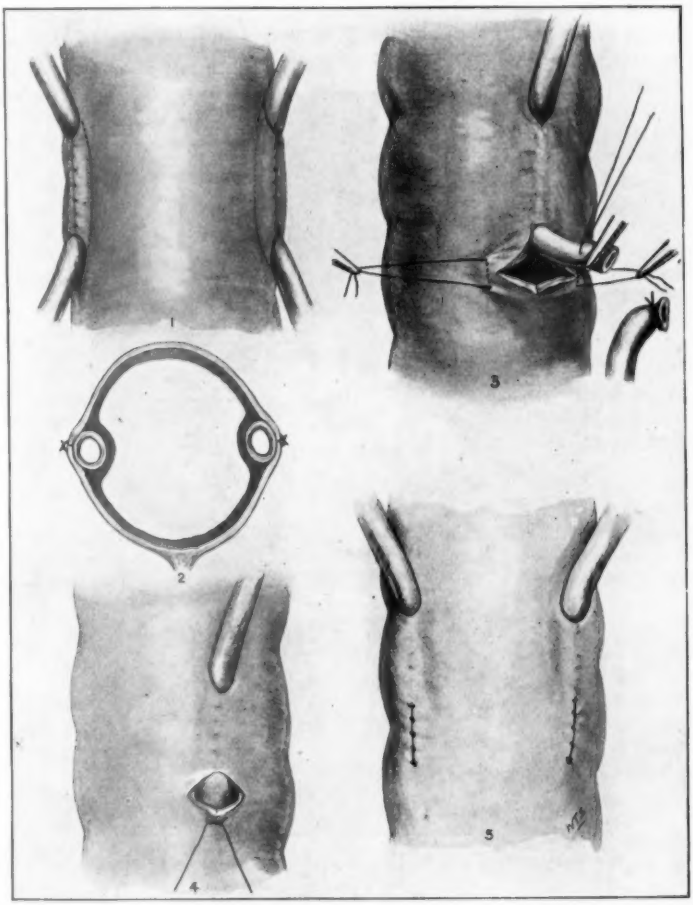

FIG. 1.

(1) The ureters implanted into the beds made for them in the wall of the pelvic colon. (2) A transverse section of the bowel at the site of the grafts. (3) The division of the grafted ureter and the insertion of its cut-end into the lumen of the bowel. (4) The fixation of the open-end of the divided ureter within the lumen of the bowel. (5) The final appearance after both ureters have been drained into the bowel.

left ureter into the bowel and grafted the right ureter; at the third time of opening the abdomen I inserted the right ureter into the bowel. I have not interfered with the bladder at all.

Following the first operation, signs of consolidation of the base of the left lung developed, but the temperature, which rose to 102° F., was quite settled by the eighth day. Some pyrexia occurred after the second operative interference, the temperature reached 101° F. on the fifth day, but was finally settled by the seventh; indications that either kidney had become infected were completely lacking. After the final abdominal section the chief reaction was a disturbance of the pulse which went up to 132 and settled to 90 on the thirteenth day. This cardiovascular upset was doubtless to be explained by the complete diversion of the urine to the large intestine. There was no elevation of temperature beyond 99° F.

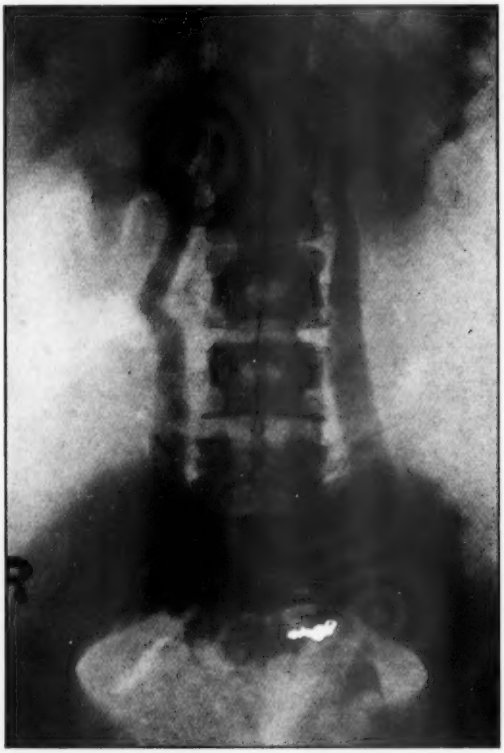

FIG. 2.—Urogram, after implantation of ureters into the pelvic colon.

In considering the post-operative reactions in this case, one fact I would emphasize is the absence of signs of renal infection following the two occasions on which one ureter was drained into the bowel. It would seem from this that the chief purpose of establishing the graft before the bowel and ureters were opened had been fulfilled. Before discharge from hospital, the patient required to evacuate the bowels every two or three hours. On several occasions there was some involuntary nocturnal incontinence.

An excretion urogram taken several weeks after the implantations were completed showed good functional activity of the kidneys, with a slight ureteral dilatation on both sides (fig. 2).

Total Cystectomy for Malignant Disease, with Implantation of the Ureter into the Abdominal Wall.

By H. P. WINSBURY-WHITE, F.R.C.S.

THIS specimen was removed from a man, aged 58, who suffered from epithelioma of the bladder. The exhibit shows the bladder bisected in the coronal plane with the prostate attached.

The most striking feature is the thickness of the bladder wall and the relatively small vesical cavity. There is nothing that, on naked-eye inspection, can be recognized as new growth One can see how fibrosed the prostate is and also that it is the seat of a small mass of calculi. The patient's history makes it clear that the malignant disease of the bladder owed its origin to the chronic prostatitis.

The patient had suffered for eight years from increased frequency of micturition; during the latter part of his illness this had become very much worse. I tried on several occasions to cystocope him without success, even though a general anæsthetic was administered. This failure was the result of the marked degree of contraction of the bladder, which, as a result of this change, would not hold enough fluid to enable the examination to be carried out, but at this stage it was simple enough to establish the fact that the patient was suffering from prostatitis, which had given rise to a very distressing form of cystitis as a complication. There was no residual urine.

About a year before I removed his bladder the patient had made a journey to Berlin, where the pre-sacral nerve was divided, in the hope that this would reduce the frequency of micturition, but the patient was not conscious of any benefit as a result of the procedure. The frequency was so marked that the patient's daily activities were chiefly concerned with seeking facilities to pass urine.

It was decided, therefore, that a permanent cystostomy would most likely give him some relief. In carrying out this procedure I made a careful inspection of the bladder and noted that in addition to a marked generalized cystitis, there was a small area of thickening in the bladder wall to be felt just above the trigone posteriorly. This part of the bladder was neither ulcerated nor raised above the surface. Its extent was about three-quarters of an inch in diameter.

I excised the mass, and the subsequent microscopical examination revealed the presence of early epithelioma. The growth was not found to be extending actually into the muscular coat.

It must be remembered that this patient had had frequency of micturition for eight years. It was therefore justifiable to assume that the malignant change was a terminal stage of his long-standing vesical irritation. Although I had removed the growth I nevertheless realized that I had left behind the predisposing cause of further malignancy. It was because of this, and in spite of the fact that the epithelioma was an early one, that total cystectomy was decided upon. Further operative procedures were carried out in two stages. At the first, the ureters were displaced so as to drain on to the skin just above the inguinal regions, and when these implantations were satisfactorily established, the bladder, together with the prostate and seminal vesicles, was removed. The patient survived this ordeal although he had a somewhat stormy convalescence, and he was able, in due course, to go about with a moderate degree of comfort, the urine draining into a portable urinal by way of two rubber tubes which were passed up the ureters.

Microscopical examination of a portion of the removed bladder showed malignant cells to be present.

About six months after the last operation the patient began to complain of constant pain in the lower part of the back and the buttocks, and although every kind of investigation—short of opening the abdomen—has failed to establish the fact of recurring malignant disease, yet one feels that the symptoms can only be explained in this way.

Two Cases of Solid Tumour of the Spermatic Cord.—JOHN SANDREY, F.R.C.S.

(I) J. B., aged 43, admitted to hospital 18.12.32, complaining of a swelling of the left testicle, first noticed three years previously, but having become much larger during the past three months. There was no history of trauma. A dragging pain was felt in the testicle and groin at times, especially after prolonged standing. Patient denied having had venereal disease.

On examination.—A large rounded swelling, the size of an orange, occupied the left half of the scrotum. In its upper part it was stonily hard, but elsewhere it was soft and semi-fluctuant. The testis was not distinguishable from the tumour, neither

FIG. 1 (Case I).—Photograph of specimen.

could any testicular sensation be elicited. The tumour was non-translucent. The spermatic cord was thickened, but the vas felt normal. There were no palpable glands in the inguinal or epigastric regions. A skiagram of the chest appeared normal. The Wassermann and Kline reactions were negative. A provisional diagnosis of testicular neoplasm was made, and orchidectomy was performed on 19.12.32.

Pathological findings.—The specimen (fig. 1) weighed 690 grm. and measured 7 by 4 in. Dissection revealed a large firm, yellowish-white, encapsulated tumour lying above the testis. The testis was quite normal. The tumour appeared to arise rom the neighbourhood of the junction of the epididymis with the spermatic cord.

Microscopic structure.—The tumour is composed of fibroblastic cells. In most parts the histology is that of a hard fibroma, but in others there are signs of

myxomatous degeneration. Groups of giant-cells and irregularly shaped fibroblasts are present in the growth and these give it the appearance of a sarcoma, probably of low-grade malignancy (fig. 2).

Pathological diagnosis.—" Fibro-myxo-sarcoma of the spermatic cord."

(II) J. S. T., aged 36, first noticed a swelling of the left testicle eighteen months before admission to hospital. This has slowly increased in size. There is occasionally a dragging feeling of discomfort in the left groin but never any actual pain. He denies previous venereal disease and does not remember any injury to that region.

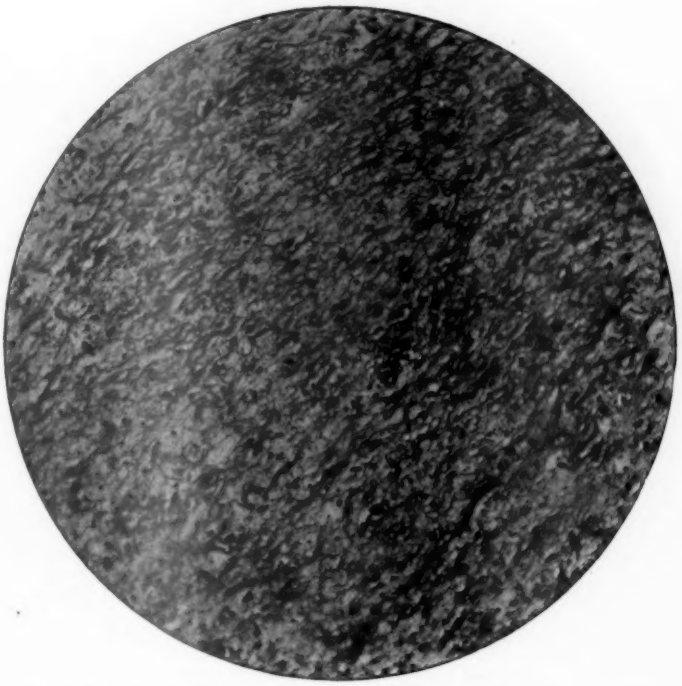

FIG. 2 (Case I).—Section through sarcomatous portion of the tumour. × 280.

On examination, a hard rounded mass, about the size of a billiard-ball, could be felt in the left side of the scrotum. The scrotal veins were dilated but there was no attachment of the skin to the underlying tumour. The testicle was displaced to the posterior and medial aspect of the tumour, which appeared to be fused to its upper pole. There were no palpable glands in the inguinal or epigastric regions and the opposite testicle appeared normal.

A provisional diagnosis of testicular neoplasm was made, and orchidectomy was performed on 9.5.32.

Pathological findings.—The specimen (fig. 3, p. 66) weighed 152 grm. A hard oval encapsulated tumour, measuring 4 in. in its long axis and 3 in. in its transverse, lay in the course of the spermatic cord at its junction with the globus major of

the epididymis. The tumour was entirely separated from the testis, which appeared to be normal.

Microscopic structure.—The tumour consists chiefly of fibrous tissue, but there is a considerable amount of smooth muscle intermingled and several small areas of calcification are present (fig. 4). The structure is that of a benign tumour.

Pathological diagnosis.—" Fibromyoma of the spermatic cord."

[I am indebted to Mr. E. T. C. Milligan for permission to show this second case with my own.]

FIG. 3 (Case II).—Photograph of Specimen.

Comment.

Tumours of the spermatic cord are distinctly rare. They are, almost without exception, mesodermal tumours and arise from the connective tissue of the spermatic cord proper.

Lipoma, fibroma and leiomyoma form the bulk of the cases described in the literature, lipoma being by far the most common.

Degenerative or sarcomatous changes tend to occur after the growth has been present for a considerable time. These changes are illustrated in the first case. Their site of origin is clear when the anatomy of the spermatic cord is considered. The vessels and duct are held together within the outer fascial coverings by loose connective tissue. This perivascular tissue is rich in longitudinal smooth muscle, the so-called internal cremaster muscle, and fatty lobules can also be demonstrated by dissection in most cases (Gabryzewski).

In view of these facts it would seem unnecessary to suppose, as some writers have done, that tumours which contain more than one of these tissues are embryonic in origin, a supposition which is further contradicted by a marked dissimilarity between the microscopic structure of these growths and that of testicular embryonic neoplasms.

In both the cases now described the tumour arose on the left side, a circumstance which is in agreement with the fact that growths of the spermatic cord, like varicocœles, are commonly left-sided.

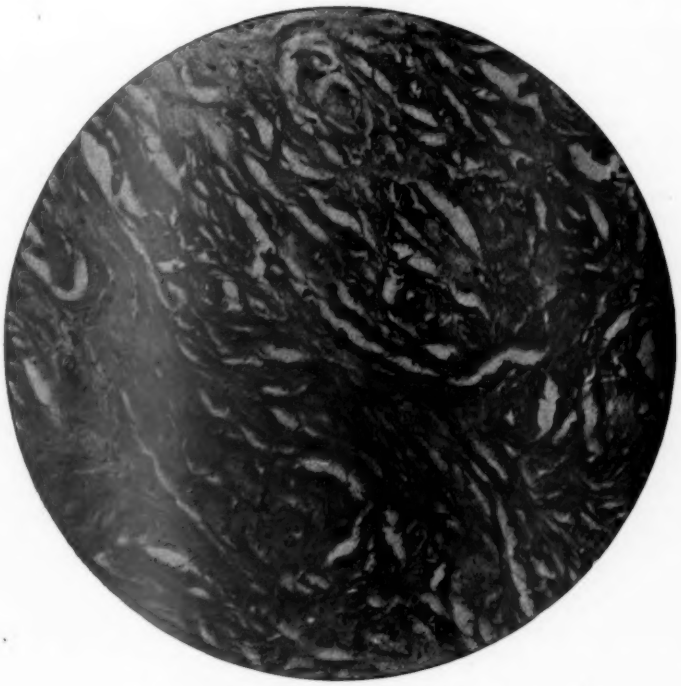

FIG. 4 (Case II).—Section through tumour. × 280.

Clinically, they arise as small discrete tumours which are intimately connected with the spermatic card and can be dragged downwards by traction on the testis. As they enlarge they tend to gravitate to the scrotum, finally enveloping the testis and rendering a clinical distinction between the two impossible. Hence the clinical resemblance to testicular neoplasm is a very close one and led to a mistake in diagnosis in each of the cases described.

Carcinoma of the Urethra, beginning in the Fossa Navicularis.—TERENCE MILLIN, F.R.C.S.

H. E. D., aged 63, drayman, admitted to All Saint's Hospital, August 2, 1932, suffering from acute retention of urine.

History.—Two years previously straining at micturition had led the patient to

discover a small nodule, palpable but not visible, just within the external meatus. Despite increasing severity of urinary symptoms, diminished stream, hourly frequency day and night, hæmaturia, and appearance of a fungating tumour mass, medical advice was not sought until day of admission.

Condition on admission.—Appearance very toxic; bladder distended above umbilicus; the penis was semi-erect, and owing to the general enlargement of the whole organ, the foreskin, formerly retractable, could not be withdrawn. A foul discharge was issuing from the preputial opening and a fungating mass was visible. The corpus spongiosum appeared to be involved by tumour almost to the bulb. A large mass of malignant glands was present in the right inguinal region; a few discrete nodes only on the left side.

2.8.32. Suprapubic cystotomy followed by gradual decompression.

15.8.32. Radical Pearce-Gould amputation of the penis. The inguinal nodes were cleared and both testes were ablated. Owing to the backward spread of the growth the urethra was sectioned close to the triangular ligament. Patient was discharged healed in the sixth week.

Subsequent course.—Self-retaining suprapubic catheter maintained for three months though satisfactory micturition was effected through the perineal fistula. There being then no evidence of local recurrence or stricturing, the suprapubic tube was removed and the fistula promptly closed.

Present condition.—No evidence of recurrence; patient has put on much weight and is back at his former employment. Micturition easy; no incontinence; no increased frequency.

Histological report.—Squamous-celled epithelioma with elementary attempts at cell-nest formation.

Commentary.—This appears to be a case of carcinoma commencing in the terminal inch of the urethra, and during its two-year growth involving almost the whole of the corpus spongiosum. There was no history of antecedent venereal disease or of any urethral instrumentation.

Section of Epidemiology and State Medicine.

President—WILLIAM BUTLER, M.B.

[*April* 28, 1933.]

The Distribution of Simple Goitre in Derbyshire.

By P. H. J. TURTON, M.D., D.P.H.

I.

INTRODUCTION.

ALTHOUGH goitre has been endemic in Derbyshire for many centuries, references to the disease in the county are scanty. The earliest record is that by Clowes [1] in 1602. White [2], in 1684, again referred to it; and Prosser [3], in 1782, recorded goitre as being endemic at Duffield. Erasmus Darwin [4], in 1796, said that the "inferior people" of Derby town were much afflicted. Saint-Lager [5], in 1867, mentioned Alfreton, Chesterfield, Cromford and Duffield as being endemic centres. In 1887, Sir James Berry [6] made a tour of inquiry, and this was the first detailed inquiry into the prevalence and distribution of goitre in Derbyshire. Dr. Harvey of Wirksworth and Dr. Fentem of Bakewell have both written theses on the subject in their own districts, and in 1923-4 I first surveyed the Urban District of Heanor. This survey was extended to the whole county in 1925, and a good part of my spare time during the ensuing five years was spent in the prosecution of this inquiry.

II.

NATURAL CONDITIONS.

Situation.—Derbyshire is one of the central counties of England between latitudes 53° and 54° north and longitudes 1° and 2° east of Greenwich. No place in the county is more than fifty miles distant from the sea.

Area.—The total area of the county, including upland waters, is 645,097 acres. The greatest length is 55 miles, and the greatest breadth is 37 miles.

Population.—In 1930, the estimated population was 624,300 excluding the Borough of Derby, the population of which is about 143,000.

Surface and general features.—The Peak District of Derbyshire forms the southern end of the Pennine Range of England, which terminates at Ambergate in the Derwent Valley. The Peak itself is a high tableland over 2,000 feet above O.D., composed of Limestone Shales capped by Millstone Grit on Kinderscout.

Many parts of the Carboniferous Limestone country (fig. 1) rise to 1,000 feet above O.D. This region is, in its upper parts, bare, bleak and monotonous; it is intersected by numerous valleys and dales whose precipitous, craggy and well-wooded walls form some of the most picturesque parts of England.

The Millstone Grit country (figs. 1a and 2), which lies chiefly to the east of the Derwent, is marked by bold and rugged escarpments rising in serried steps above

FIG. 1 (*a*).

FIG. 1 (*b*).

FIG. 1.—SCENES ILLUSTRATING CHARACTER OF LIMESTONE REGION OF DERBYSHIRE.

(*a*) **Derwent valley at Matlock, showing carboniferous limestone to right, and, in the centre, the river gorge, millstone grit escarpment to left, with limestone shales intervening.**

(*b*) **Middleton Dale. In the distance is the village of Stony Middleton, where goitre used to be endemic.**

the river, whilst the dip slopes in their highest parts form peaty and heathery moors.

In the Erewash Valley, on the Coal Measures in the eastern part of the county, there are few or no distinguishing features. It is a broad and shallow valley, the scene of many busy industries associated with coal mining, iron manufacture, pottery, bricks, hosiery and lace. The neighbouring country traversed by the stream seldom exceeds 400 feet above O.D. North of Chesterfield, the Coal Measures are characterized by rolling hills with intervening valleys, running in an east-west direction, owing to transverse folding of the strata, and here the surface features are formed of sandstone, in contrast with the southern parts of the coalfield, where they are replaced by thick beds of clay.

The north-eastern corner of the county is characterized by a rich agricultural belt which marks the outcrop of the Magnesian Limestone. This region is intersected by numerous fissures and valleys.

FIG. 2.—Upper region of millstone grit, near Birchover, with remains of Druid circle in centre.

In the south of the county, there is a region of low-lying foot hills rolling into the Trent Valley. The lowest parts are little more than 100 feet above O.D. South of a line drawn between Ashbourne and Sandiacre is the area covered by the Trias outcrop, the Bunter Sandstone, and the Keuper Marls and Sandstones. Much Glacial Drift is scattered over this area and the whole of the Bunter is sealed with drift.

Climate and rainfall.—The climate is temperate and equable. The prevailing wind is south-west. The mean temperature at Buxton from 1881-1900 was 45.2° F., and at Belper it was 47.3° F. The average amount of sunshine at Buxton from 1904-08 was 1,334 hours, compared with 894 hours at Manchester and 1,234 hours at Westminster.

The lowest rainfall, less than 25″, is confined to the low ground of the Trent Valley, and the isohyetal line of 25″ coincides roughly with the contour line of 100-150 feet of elevation. In the extreme south of the county, the rainfall rises above 25″ along the slopes of the higher land of Leicestershire. The zone of rainfall between

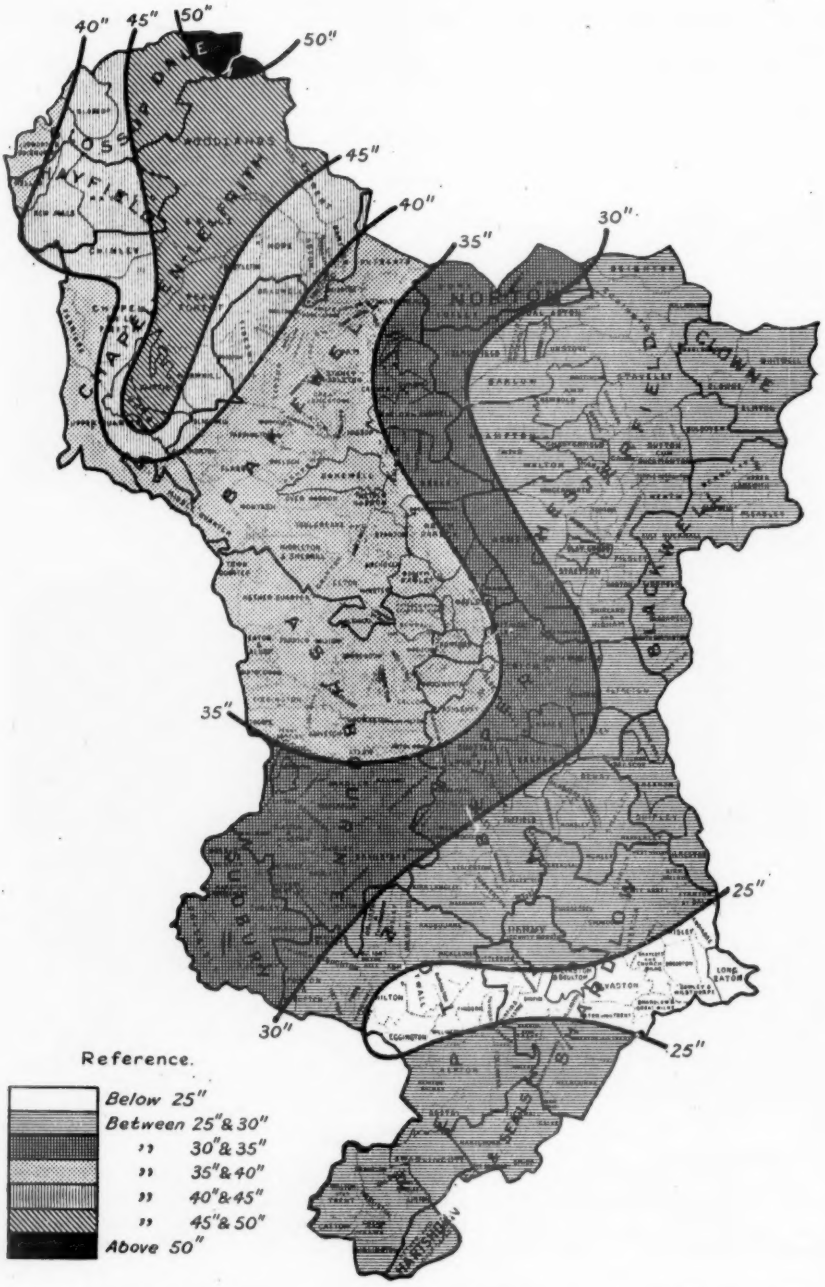

FIG. 3.—Rainfall map of Derbyshire, based on readings at 88 stations over a period of thirty years.

25″ and 30″ runs in a concavo-convex direction to the west with its greatest width north of Chesterfield. The isohyetal line of 30″ follows approximately the contour line of 500 feet of elevation, that of 35″ keeps near the line of 800 feet, whilst that of 40″ keeps near the contour line of 1,000 feet. The highest zone of rainfall, that between 45″ to over 50″, is in the region of the 1,500 to 2,000 feet contour lines of elevation.

III.

Standards adopted in the Survey.

A lack of uniformity in standards has been deplored by all surveyors. There are manifestly wide variations in the methods of assessing thyroid enlargements. A uniform standard is desirable. The standard I have adopted in this survey was a

Fig. 4.

(i) "Incipient goitre" (*), according to the scale adopted. Lobes of gland are just visible.

visual one. Stocks [8] has published methods of measurement and of record of thyroid enlargement, and he condemns the estimation of goitre by visual standards owing to the liability of error from "the personal equation." The conditions under which I did this survey would have made his method impossible.

The thyroid glands have been classified as follows:—

(1) *Normal.*—Where no enlargement is seen on inspection or deglutition.

(2) *Incipient goitre.*—Where the isthmus or lobes are either seen or felt as a slight thickening on inspection, or observed on deglutition (*).

(3) *Small goitre.*—Where the enlargement causes definite alteration in the contour of the neck detected on inspection alone (**).

(4) *Medium goitre.*—Where the enlargement causes lateral or anterior bulging producing a deformity on superficial inspection (***).

(5) *Large goitre.*—Those excessively enlarged and obvious on casual inspection (****).

Fig. 4 (i) to (iv), illustrates the degree of thyroid enlargement according to this scale.

(ii) FIG. 4. (iii)

(ii) Small goitre (**) according to the scale adopted.
(iii) Medium goitre (***) according to the scale adopted.

FIG. 4.
(iv) Large goitre (****) according to the scale adopted.

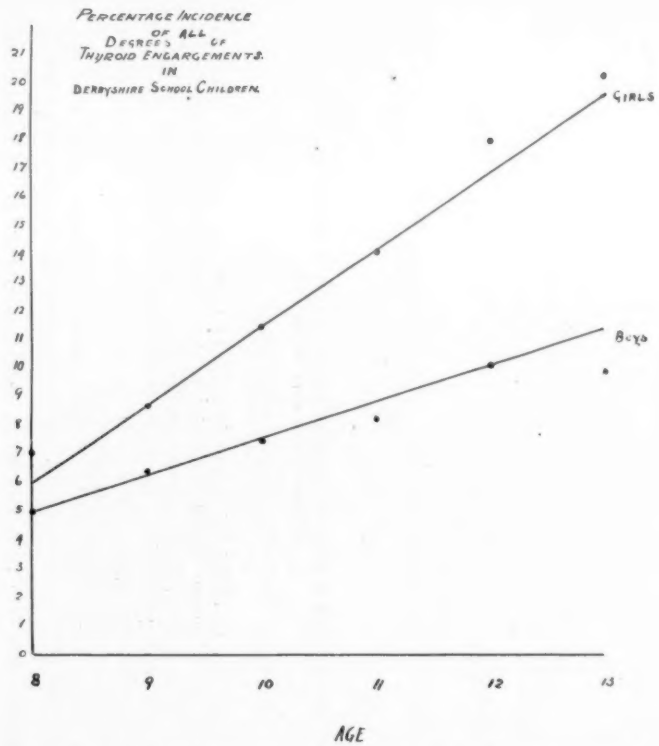

CHART A.—Showing incidence of all degrees of thyroid enlargements in Derbyshire school children, in the age-groups 8-13; based on an examination of 40,044 children.

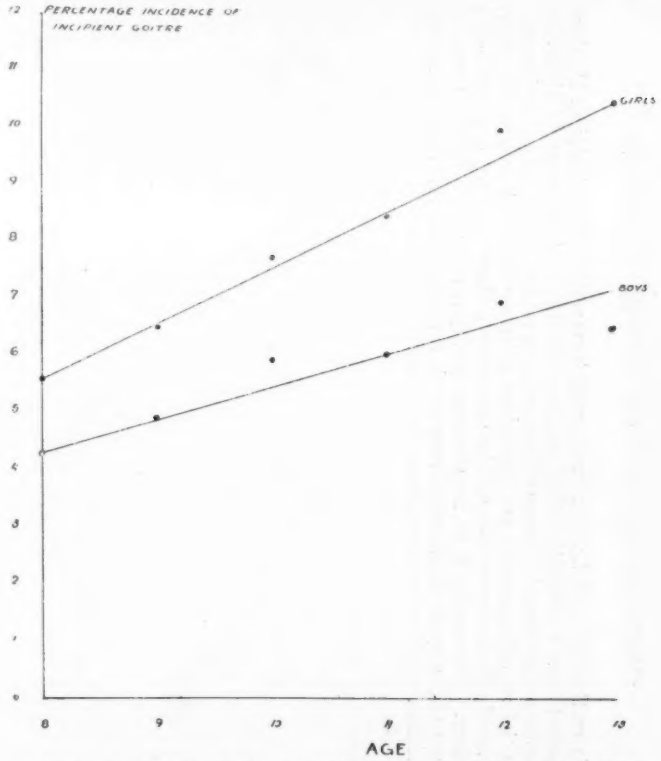

CHART B.—Showing incidence of "incipient goitre" in boys and girls in the age-groups 8 to 13, Derbyshire elementary schools, based on an examination of 40,044 children.

This method I have found to work well in practice. The incipient (*) thyroid enlargements are not worthy of the name of goitre. I have assessed them, but I have not included them in the records except the tables of age and sex incidence. If these incipient enlargements are classed as goitres, a term which signifies thyroid disease, a wholly erroneous idea will be gained as to the prevalence of thyroid *disease* in children. The trouble is to know where to begin and where to stop: one is in the same difficulty in deciding as to when is a man drunk and when is he sober, after alcohol.

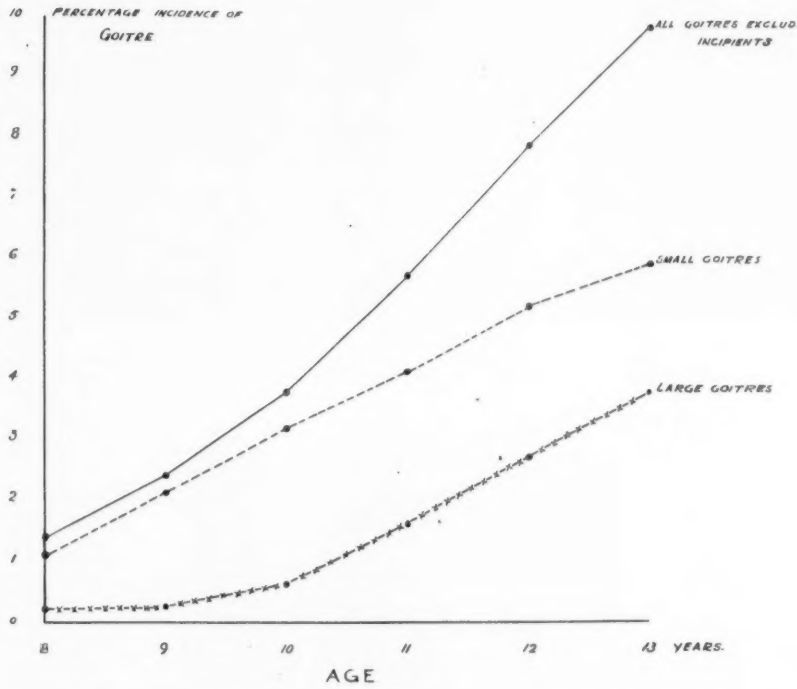

CHART C.—Incidence of goitre in girls aged 8 to 13 years in Derbyshire schools, based on an examination of 20,074 children.

The incidence of childhood goitre is only of value as evidence of prevailing thyroid disease when considered in relation to the other criteria of endemicity—the prevalence of cretinism, the proportion of the sexes affected, and to the prevalence of goitre in the adult population. Thyroid enlargements in children have a marked tendency to disappear spontaneously, and to vary in size from week to week, a fact often forgotten, or not generally appreciated.

This survey covers the whole of Derbyshire. The total number of children examined was 40,044[1], of whom 20,074 were girls and 19,970 were boys between the

[1] If the earlier Heanor survey be included the figures are 42,905 (21,639 girls and 21,266 boys).

ages 8-13 years inclusive. Prior to 8 years of age goitre is uncommon, though I have seen a good number below that age, and a fair number of congenital cases. Cretins are a rarity. I have seen a few—at Wirksworth, Unstone, Heanor, and, outside the county, at Mansfield and Brinsley in Nottinghamshire.

The children examined were those attending the elementary schools, and, for the most part, their parents belong to the artisan class. I have inquired personally and by letter of many Derbyshire doctors as regards the incidence and distribution of goitre in the adult population and I have also searched the records of the Derbyshire

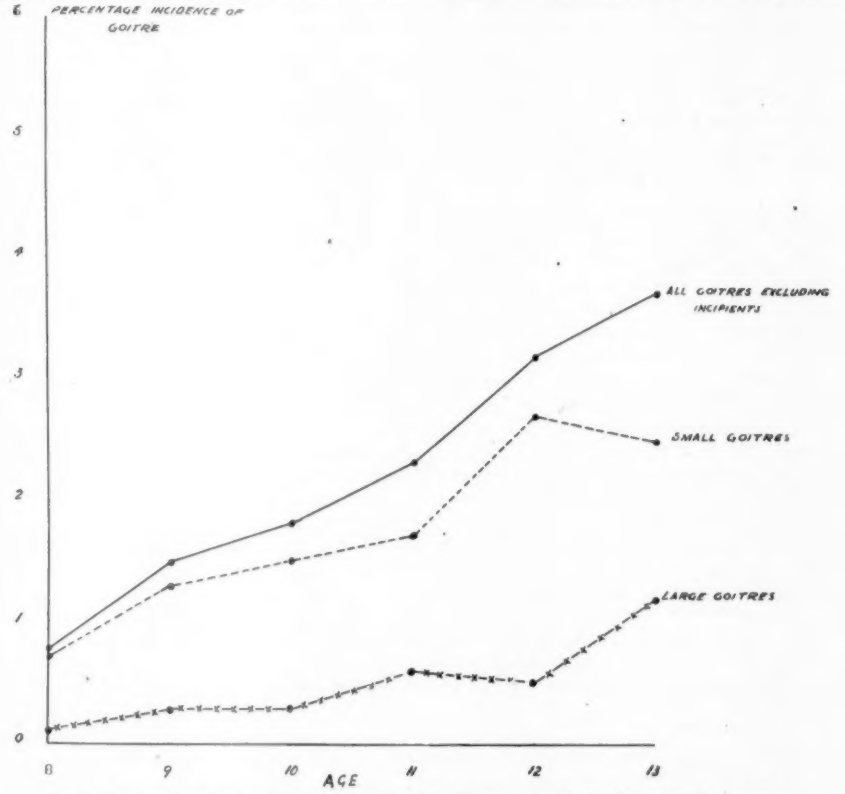

CHART D.—Incidence of goitre in boys aged 8 to 13 years in Derbyshire schools, based on an examination of 19,970 children.

Royal Infirmary (see Table XIII) and the Manchester Royal Infirmary (see Table XIV) over a large number of years. Time and opportunity have not permitted me to extend the search to the records of the Nottingham or Sheffield hospitals

IV.

THE GEOLOGY OF DERBYSHIRE.

"The whole of Derbyshire," said Farey [7], "is based on Mountain Limestone, which, after forming the surface of the districts before described, sinks down on every side and is covered by coating after coating of the superior rocks, the Limestone

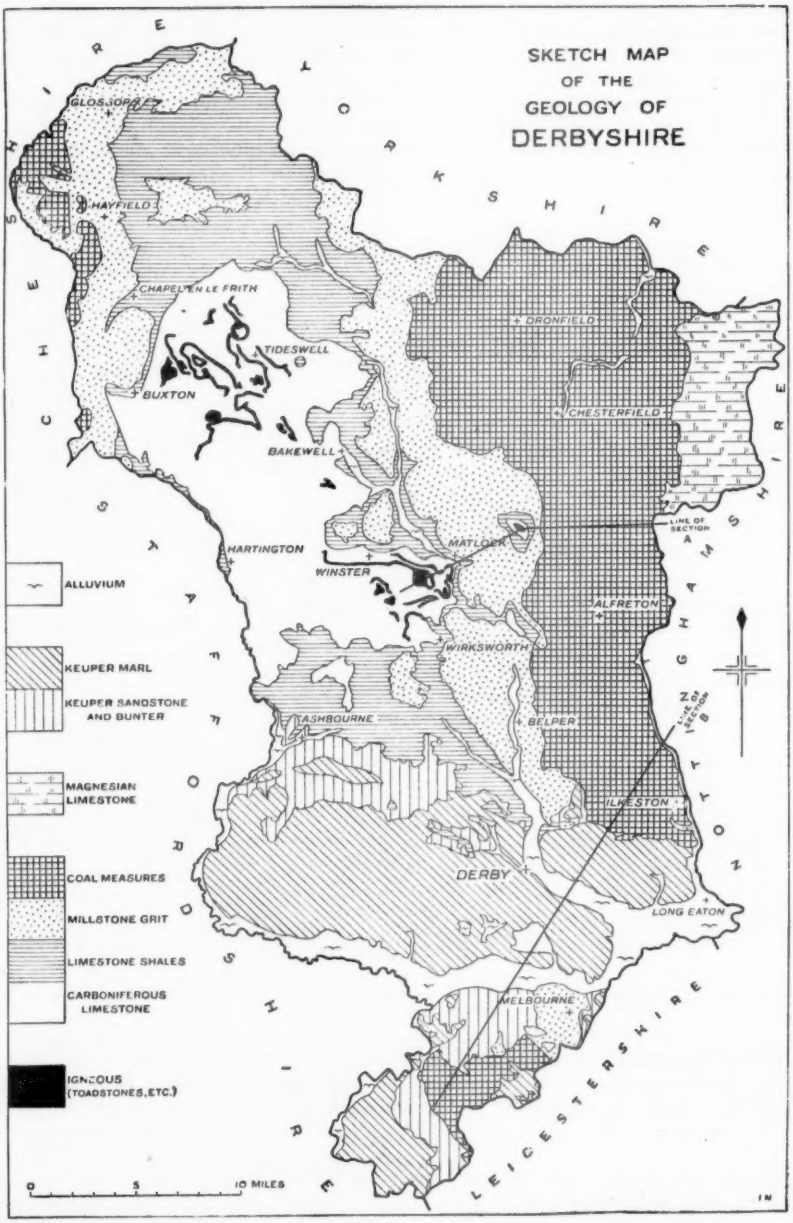

FIG. 5.—(Reproduced from "The Wells and Springs of Derbyshire," by permission of the Controller of H.M. Stationery Office. *Crown copyright reserved.*)

Shales, the Millstone Grit and the Coal Measures. All these are always conformable to each other . . . and being, in fact, only different parts of one component and continuous mass of rocks, all the four insensibly melting, as it were, into one another, and forming one whole."

Carboniferous Limestone.—This is the lowest and oldest member of the series. The main outcrop covers an irregular area of twenty-two miles from north to south, and twelve miles from east to west. There is abundant proof of contemporaneous volcanic action. Volcanic vents occur at Grange Mill, Hopton, Tissington and Ashover. There are deposits of volcanic ashes, tuffs, tufaceous limestones, masses of igneous and calcareous agglomerate and sills. Two lava flows have an extensive distribution, and are known locally as "toadstones." They are basic in character, and are composed of olivine-dolerite. Nodular layers of chert occur in the upper beds; much of the limestone contains a large proportion of silica. Bituminous matter occurs as an inclusion in many parts. A great deal of the limestone has undergone dolomitization both above and below the lava. Two inliers occur at Ashover and Crich as periclinal hills on the same anticlinal saddle. Smaller inliers occur at Calke Abbey, Snelston and Ticknall.

The rainfall is high (35″ to 40″), but, on account of underground drainage, the whole of the upper regions of this member is practically devoid of water. This is due to the prevalence of jointing and fissuring. The scarcity of water in this region accounts for the sparse population, and hence the small amount of goitre which has been found there. Where water occurs in this formation, the springs are due to impervious beds of shale or toadstone, the upper layers of which have decomposed, forming an impervious clayey bed. Water reaching these beds by percolation is then thrown out at the junction of the two types of rock as springs. In other regions the people rely on rain water stored in meres or underground tanks. Meres are shallow excavations puddled with clay and lined with blocks of stone.

The springs are of two kinds: those which issue from above the lava and those which issue from the limestone through faults in the lava. Were it not for the lava flows and impervious clay partings, there would be no springs in the limestone at any considerable horizon. Springs which issue from above the lava occur at Bonsall, Chelmorton, Taddington and Tideswell. The deep springs issuing through lava faults are invariably thermal, and their volume is remarkably uniform, the temperature varying from 48° to 65° F. The Heanor and Ilkeston supply is obtained from one of these latter sources.

Owing to the absence of filtration in percolating through joints and fissures, and also owing to the fact that all absorption areas have been built upon, the water supplies from this formation are extremely liable to organic or animal pollution. In addition, the raw or untreated waters are very calcareous, with a high total hardness.

Goitre in the Limestone region.—The Carboniferous Limestone region of Derbyshire has always been a goitrous region. "Over the whole of this area in Derbyshire," said Berry [6], "but especially along the eastern border of it, I found numerous cases, for example, in the neighbourhood of Cromford, Matlock, Youlgreave, Bakewell, Baslow and Stony Middleton. The same may be said of the region on the north side of Ashbourne, and I am told that the disease is also common over the similar district in the east of Staffordshire." As in other parts, it is less common now than in 1887, when Sir James Berry toured the county on his goitre inquiry. A number of places have, since then, been supplied with water from the Millstone Grit, with the result that the disease has either disappeared or greatly diminished. Places in this area affected to a great degree at the present time are Brassington, Bonsall, Carsington, Hartington, Middleton by Wirksworth, Middleton by Youlgreave, Parwich, Peak Forest and Tideswell. Most of these places depend on surface wells or springs whose purity is open to doubt.

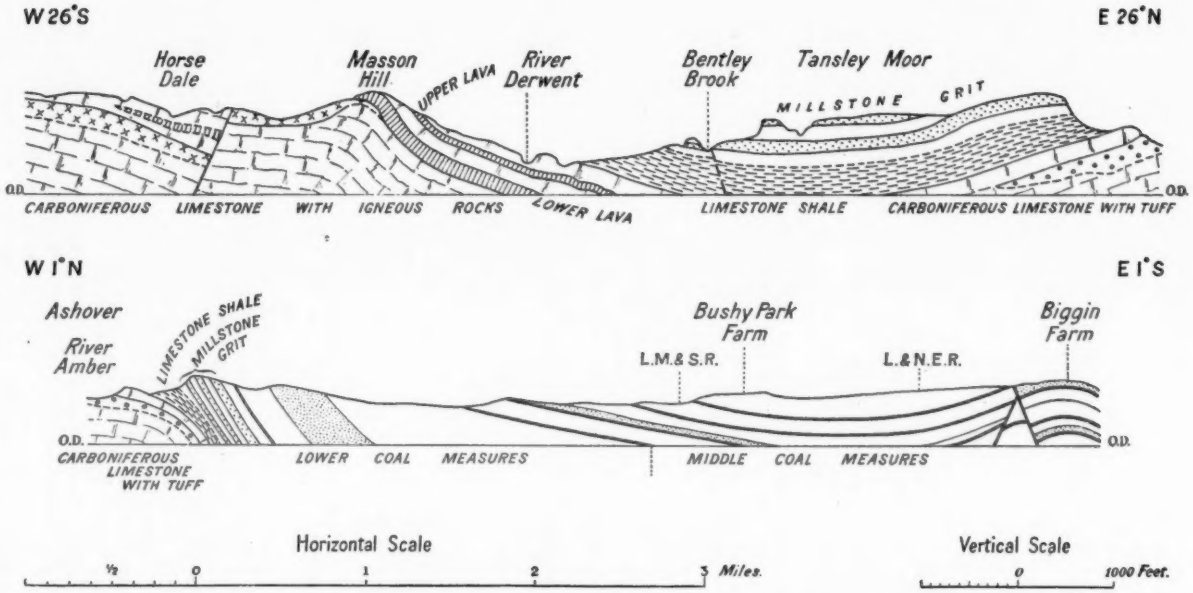

FIG. 6.—Section along the line A of the map (Fig. 5). (Reproduced from "The Wells and Springs of Derbyshire," by permission of the Controller of H.M. Stationery Office. *Crown copyright reserved.*)

The incidence of goitre in children is 6·7% (** or over) and 2·2% (*** or over). I have not included the earlier Heanor figures in this estimation. If I had done so the incidence would have been much larger than the one given. (Tables I and Ia, p. 62.)

Limestone Shales.—In Derbyshire, the intermediate tract of rocks above the Carboniferous Limestone and below the Millstone Grit is known as the Limestone Shales. They consist of dark clay shales with some thin bands of limestone at their base. Their outcrop is usually marked by a broad depression between the rising ground of the Carboniferous Limestone on the one side, and the steep escarpment of the Millstone Grit on the other. Ironstone nodules occur throughout. The upper parts of the series include beds of fine grained sandy rock and flags of a hard, white sandstone. The outcrop extends over a large tract of country north and south of the Limestone, with less extensive exposures in the central part of the county in the Derwent Valley (see fig. 5).

These rocks are not water-bearing to any great extent. They are chiefly of importance owing to their being impervious, and conducting to the surface water which percolates through the Millstone Grit. Some important water undertakings derive supplies from this formation as upland surface supplies (Derwent Valley Water Board). These organized supplies are generally of good quality, the hardness is low, but springs and surface wells, as elsewhere, if uncontrolled, are very liable to fæcal pollution. Particularly is this the case in the southern part of the outcrop.

Goitre in the Limestone Shales region.—At Bradwell, Castleton, Elton and Great Hucklow, some of the goitrous children obtained water from the Carboniferous Limestone through surface wells. If these are excluded, the incidence of goitre is considerably less, and increases the incidence of goitre in the preceding formation. Most of the other places such as Bamford, Great Rowsley, Idridgehay, Kirk Ireton, Kniveton and Turnditch show no evidence of goitre to a marked degree, and this is what one would expect in localities whose water supplies closely resemble those of the Millstone Grit. Those areas which take water from this formation as upland surface waters also show very little goitre.

The incidence of goitre in children in this region is 6·6% (** or over) and 1·9% (*** or over). (Tables II and IIa, p. 63.)

Millstone Grit.—The Millstone Grit covers a large part of the county. The outcrop is marked by steep escarpments, with the dip slopes forming moorland country. It consists of thick beds of quartsoze sandstone with intercalated bands of shale. They are very compact and massive. Thin seams of coal occur occasionally.

This formation yields numerous springs which act as overflows of underground reservoirs. Water percolating through the grit comes in contact with impervious shale partings, and tracking along above these, overflows at some point along the outcrop. As the general dip is to the east, water falling on the western bank of the Derwent runs off like water on a roof, and it is on account of the eastern trend of the dip that most of the springs are situated on the east bank of the river. Hence all the villages are on this bank of the Derwent. Numerous upland surface gathering grounds are used for water supplies, the chief being the Manchester Corporation (part), the Boroughs of Glossop, Chesterfield and the Rural District Council of Chesterfield (Northern and Southern Scheme). Alfreton Urban District takes a part supply from upland surfaces on the Millstone Grit.

The upland surface waters of this formation are usually of exceptional purity and softness, but where the gathering ground is cultivated this is not the case as regards absence of pollution.

The spring waters are very variable—some soft, others very hard. Their purity is open to doubt in a number of cases. Long Eaton supply was discovered to be liable to pollution from seepage of the polluted Trent water getting in through

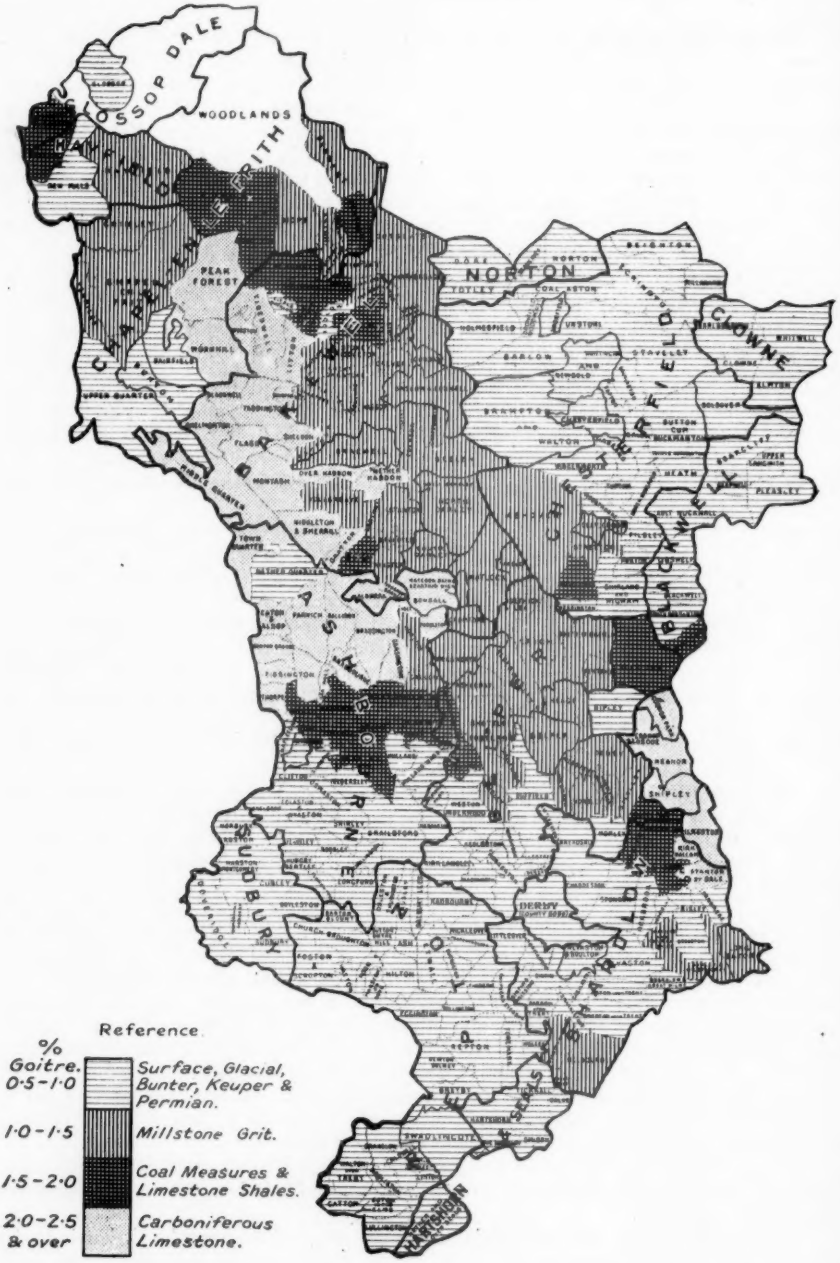

FIG. 7.—Map of Derbyshire showing distribution of goitre (*** and over, i.e., medium and large goitres) in Derbyshire children in the combined districts deriving water supply from the geological formations. Unshaded area is uninhabited.

heavy pumping. Contrasted with the waters derived from the Carboniferous Limestone, the Millstone Grit waters are, in general, greatly superior in quality both as regards mineral content and liability to fæcal pollution. Nevertheless, waters obtained from deep borings often show a close approximation to the analyses of limestone waters. This is due to the water having circulated for long periods and distances underground.

Goitre in the Millstone Grit region.—The Millstone Grit has been stated to be free from goitre. Excluding all possible sources of error arising from some places with a water supply from more than one formation, such as the limestone, e.g., at Ashford, Calver or Curbar, the incidence in this region as compared with the limestone is about 4 to 1 in favour of the limestone. Many places previously supplied with water from the limestone were goitrous to a great extent, but since changing over to supplies from the grit, goitre has diminished to a large extent. The region is not entirely goitre-free. In 1782, Prosser (3) found goitre common at Duffield. In many cases the disease appears to be associated with bad water supplies. For example, at Ashover the village has a good water supply. The children at the school come from a scattered area: these depend upon doubtful sources of water. Of all the goitres seen at this school, 84% were associated with supplies other than the village itself. On another occasion when I examined these children, 72% were similarly outside cases. The village of Beeley was at one time so badly affected that there was scarcely a person who was not goitrous. At that time, water was obtained from a brook issuing from springs in the grit, and it was then and still is a grossly polluted stream. At New Mills and Hayfield and in the Goyt Valley generally a fair amount of adenoparenchymatous goitre exists at the present time. Wirksworth still shows a good deal, and I am unable to associate it with the water supply in any way whatever. Many places are entirely goitre free.

The percentage incidence of goitre in children in this area is 5·1% (** or over) and 1·27% (*** or over). (Tables III and IIIa, pp. 63-65).

Coal Measures.—This is the highest division of the Carboniferous System. It consists of clays, shales, calcareous sandstones and coal seams with some bands of ironstone. The outcrop forms a well-defined tract of country between the Millstone Grit to the west and the Magnesian Limestone to the east. In the south-east there is a small extension of the Leicestershire coalfield into the county, whilst in the north-west around Mellor, Chisworth and Chinley the Lower Coal Measures of the Lancashire coalfield crop out (see fig. 5).

The water supplies obtained from this formation in Derbyshire, from underground sources, are invariably bad, except those obtained from the occasional sandstones, which often contain large quantities of water. Owing to extensive mining and also that areas free from dwellings are very limited, the Coal Measures on this side of the Erewash Valley cannot be looked to for a satisfactory supply. The waters obtained are often quite unusable, owing to gross organic pollution and excessive mineral matter. The Derbyshire Coal Measures differ from those of many other districts, such as South Wales, in the fact that they consist of shales or clays, which yield only a scanty supply of highly mineralized water.

Goitre in the Coal Measures region.—St. Lager [5] mentioned the Derbyshire and Nottinghamshire coalfield as being a goitrous one. I have gathered a great deal of information which shows that all parts of the coalfield of Derbyshire were very goitrous in the past. In the Heanor district, many years ago, goitre was very common indeed, long before the present water supply was in use. It was also common in the northern part around Chesterfield. At the present time it is not nearly so severe in adults. Dronfield and Unstone are two places where it is fairly prevalent at the present time, but, on the whole, goitre does not present a severe problem in the Chesterfield area, where the water supply is derived from upland

surfaces. Pinxton is the one place where goitre is common in association with Coal Measure water supply obtained from underground sources.

The incidence of goitre in children deriving water supply from the Coal Measures is 5·8% (** and over) and 1·6% (*** and over). (Tables IV and IVa, p. 65).

Magnesian Limestone.—The Permian crops out in the north-eastern part of the county (see fig. 5). The appearance is marked by a clean-cut escarpment, broken only by the small valleys traversed by streams which flow in an east-west direction. At Bolsover the escarpment rises to over 600 ft. above O.D. The Permian system consists of two members, the Magnesian Limestone and a series of Marls. The outcrop of the limestone has the appearance of a dissected plateau, with ramifying valleys, whose walls are somewhat steep and craggy, as at Cresswell.

Much water is retained in the joints and fissures of the limestone, but, as with the Carboniferous Limestone, the supplies are very subject to gross organic pollution. Surface well waters are almost invariably polluted: of 22 samples of a public supply, 21 were returned as polluted with animal matter, and out of 9 samples examined 4 were returned as polluted. The raw waters are also highly mineralized.

Goitre in the Magnesian Limestone region.—Sir James Berry [6] said: "It has long been a favourite belief that magnesian limestone is especially associated with goitre, but I doubt whether there is much truth in this. In part of the Magnesian Limestone area of Nottinghamshire I found goitre to be distinctly rare. In other parts it appears to be less common than upon the Carboniferous Limestone. It is said to be common in the neighbourhood of Knaresborough, in Yorkshire." As in the case of the Coal Measures, the Magnesian Limestone is very variable in composition. I found goitre to be fairly common at Palterton and Upper Langwith, where surface wells are in use as well as the public supply. Otherwise there appears to be little goitre in this region of Derbyshire. The incidence of goitre in children in this region is 2·5% (** or over) and 0·7% (*** or over). (Tables V and Va, p. 66).

Bunter sandstone.—The Bunter has its main outcrop between Ashbourne and Quarndon (see fig. 5). The surface is sealed with boulder clay. Various divisions are described. The pebble beds are the best developed and consist of coarse-grained sandstone with scattered pebbles of quartz or other rocks.

The quality of the water obtained from the Bunter in Derbyshire does not approach that obtained from the Millstone Grit, as is the case in other areas on account of the surface being sealed with Glacial Drift: consequently, the water is derived from a distant source. Many of the surface wells in Ashbourne were found to be polluted, particularly those in the town itself.

Goitre in the Bunter region.—"Upon the triassic division of the new red sandstone," said Sir James Berry [6] "goitre appears to occur very sparingly at all . . . Upon the triassic rocks of South Derbyshire it appears to be almost absent—at least such is the case at Findern, Newton Solney, Foremark and Repton . . . Over the large area in which this rock comes to the surface in Nottinghamshire the disease appears to occur but rarely." Ashbourne, Sandiacre and Quarndon are the only places in Derbyshire which have a public supply from the Bunter. Little or no goitre appears in any of these places. Very little appears to have occurred in the past. The goitrous region has always been to the north of Ashbourne and district. Duffield appears to be more than usually affected at the present time.

The incidence in children is 2·2% (** or over) and 0·78% (*** or over). (Tables VI and VIa, pp. 66, 67).

Keuper Marls and sandstones.—The Keuper Marl consists of bright red marls with intercalated bands of skerries and occasional bands of thin red sandstone. The skerries and sandstone often contain pseudomorphs of rock salt. Gypsum occurs extensively.

The water obtained from the Keuper Marl (see fig. 5) is both scanty in quantity and unsuitable in quality from its great hardness. It is often so hard as to be quite undrinkable. Very few villages have an organized supply; where glacial beds occur along the main Keuper outcrop, the springs issuing from them are utilized.

Goitre in the Keuper Marl region.—Sir James Berry [6] has remarked upon the scarcity of goitre in this region of Derbyshire. This was in 1887. To-day a similar state of affairs exists. There are very few places where goitre occurs. At Linton I found a fair proportion of cases, and I have been informed that it was not uncommon years ago at Castle Gresley. This latter place is on the southern edge of the South Derbyshire coalfield. At Linton, there is a public supply through the South Staffs. Water Co. Of all goitres seen, 61% were associated with those drinking surface well water, whilst of the *** or **** goitres, 100% were associated with surface well users. Some cases occur at Church Broughton, Coton-in-the-Elms, Darley Abbey, Hilton, Mickleover, Netherseal, Overseal, Ticknall, Weston on Trent, Ashton on Trent and Woodville. Altogether, it is not a serious factor in this region. The incidence in children is 3·8% (** or over) and 0·8% (*** or over). (Tables VII and VIIa, pp. 67, 68.)

Glacial sand and gravel (pleistocene).—The Glacial Drift deposits in Derbyshire are only extensively developed in the Triassic area. They consist of boulder clay with sand and gravel. Where the sand and gravel beds overlie the boulder clay or the equally impervious Keuper Marl, they form efficient reservoirs which are used in many places between Ashbourne and Sudbury, the water being obtained from springs or tapped by means of shallow wells. Brailsford, Clifton, Doveridge, Norbury, Osmaston and Sudbury derive their water supplies from this formation. They are very liable to surface pollution.

Goitre in the pleistocene region.—Very little goitre has ever existed in this area, and the same is the case to-day. At Brailsford, there is little in the village itself, but within a radius of five miles cases are said to be not infrequent, especially at Muggington. Some marked cases are said to occur at Doveridge in old people, and a little at Sudbury. Otherwise it is very rare.

The incidence in children is 2·8% (** or over) and 0·7% (*** or over). (Tables VIII and VIIIa, p. 68.)

Upland surface supplies.—A large number of districts are supplied from upland sources. The Derwent Valley Water Board and the Manchester Corporation at Longendale are two of the largest undertakings. Glossop Borough has a similar supply. New Mills U.D. obtains most of its water from upland sources. Buxton Borough takes the whole of its supply from the Stanley Moor and Burbage reservoirs. The Chesterfield R.D.C. has two schemes, a northern at Barbrook and a southern at Press, near Ashover.

Chesterfield Borough and Alfreton U.D. take part supplies from catchment areas on the Millstone Grit and Lower Coal Measures. Alfreton U.D., Long Eaton U.D., Ripley U.D., and Derby Borough take part bulk supplies from the Derwent Valley Water Board. Most of the surface supplies are gathered from Millstone Grit catchment areas.

The quality of the waters obtained from this source is good, the mineral content is low, and as a rule they are free from animal pollution. Some, however, are liable to animal pollution, and are not filtered. Gross pollution has occurred in the Alfreton supply.

Goitre in the surface supply region.—Goitre is very rare at Buxton: many doctors have not seen a case native to the town. Goitre used to be very common over the coalfield: the extent of the disease has been much exaggerated at Chesterfield and region at the present time. When shallow wells were in common use, it was very common all over the coalfield, but has since greatly diminished particularly since the introduction of improved water schemes. Goitre appears to be fairly prevalent at Dronfield Woodhouse, Unstone, Shirland and Higham, Mastin Moor

and Sutton-cum-Duckmanton. The distribution of goitre in the three large Chesterfield schemes shows a remarkable uniformity, viz., 0·7%, 1·0%, 0·9% (*** or over). Some cases occur at Dore and Totley both in children and adults.

The incidence of goitre in children is 2·8% (** or over) and 0·8% (*** or over). (Tables IX and IXa, pp. 69, 70.)

V.

Types of Simple Goitre in Derbyshire.

Four types of simple goitre are described, each one as important as the other, and differing in their ætiology, epidemiology and pathology. The description of these is based on the work of Williamson and Pearse [9].

They are:—

(1) Hypertrophic goitre.

(2) Primary perilobular fibrosis, known in the literature as adenoparenchymatous goitre, cystic goitre, nodular goitre, and cystadenomata.

(3) Diffuse colloid goitre or vesicular goitre.

(4) Lymph-adenoid goitre.

The term "endemic goitre" includes more than one type of goitre. In Derbyshire, it is difficult to find one area where the type is pure and unmixed with other

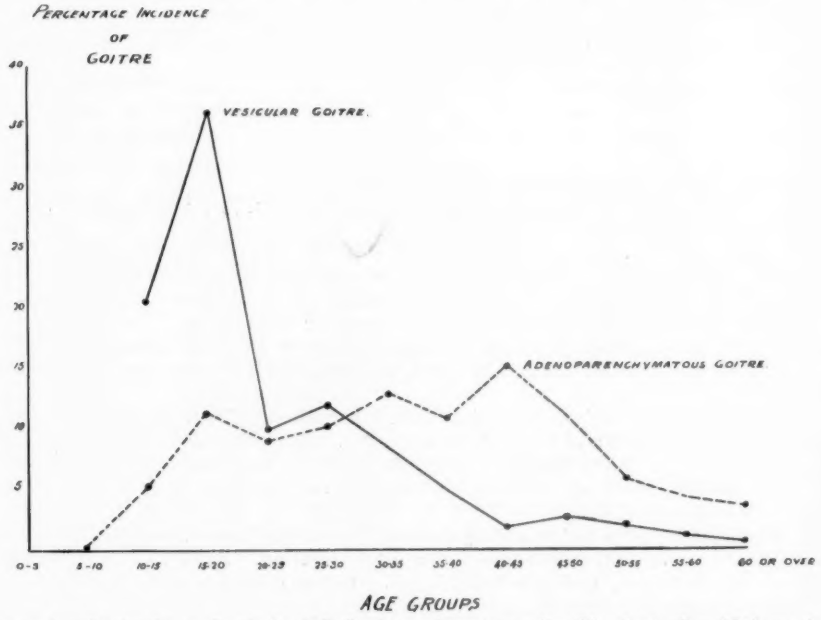

CHART E.—Age incidence of vesicular and adenoparenchymatous goitre (Manchester Royal Infirmary).

types. The differentiation of vesicular goitre and hypertrophic goitre depends upon clinical facts (Williamson and Pearse [10]). The first is a thyroid swelling with definite hypothyroidism, whilst the second is a thyroid swelling with neither hypothyroidism nor hyperthyroidism. Hypertrophic goitre and adenoparenchymatous

FIG. 8 (i).—Hypertrophic goitre in a boy aged 13 years.

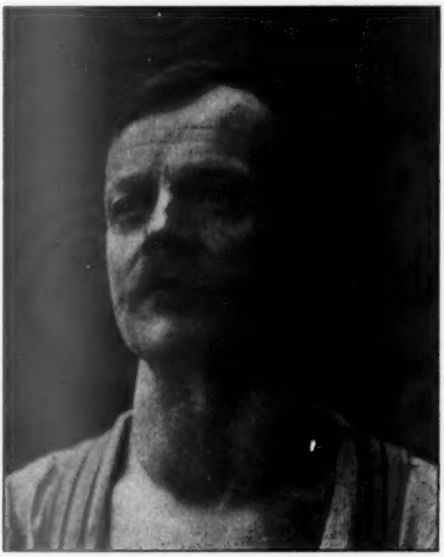

FIG. 8 (ii).—Adenoparenchymatous goitre in a man aged 40 years.
(Both Heanor cases.)

FIG. 8 (iii).—Cyst-adenoma of left lobe of thyroid.

FIG. 8 (iv).—Pendulous cystic goitre in an aged woman, illustrating the type of goitre in Derbyshire now rapidly becoming extinct. Note the placid and facile expression of the face.

goitre appear to me to be identical in a clinical sense, the first occurring at an earlier age than the other.

Hypertrophic goitre.—This type of thyroid enlargement may be physiological and is then associated with puberty, pregnancy, oöphorectomy and ovarian disease. Colloid storage is less obvious than in the average normal, and secreting tissue is not focal; both are diffusely distributed throughout the gland. When pathological, it is associated with status lymphaticus and sudden death. It is one form of endemic lesion. Secondary fibrotic changes may arise, when dysthyroidism and secondary Graves' disease complicate it.

Hypertrophy occurs in normal individuals particularly from 9-16 years of age. It is of great importance to recognize this type of thyroid enlargement, otherwise

FIG. 9.—Progressive vesicular goitre in a girl aged 15 years, seen at Shipley. Definite signs of hypothyroidism were present.

every swelling in the neck due to the thyroid enlargement may be treated as pathological (Williamson and Pearse [9]).

In adenoparenchymatous goitre there is fundamentally a coarse fibrosis of the interstitia with every form of retrogression and degeneration of the parenchyma. It may be intoxicative. It is associated clinically with solitary and multiple cysts, cystadenomata, adenoma, infiltration tumours and fœtal adenoma. This is the classical type of endemic goitre occurring in mountainous regions and is the type most associated with cretinism and deaf mutism. This is the type most common in the older generation of Derbyshire people. It is the one described to me so often by doctors as the "poor man's disease." There is a marked hereditary tendency in this type of goitre. It is less common in children than in adults, and, in regions of

FIG. 10.—Vesicular goitre in retrogressive stage in Heanor coal-miner.

FIG. 11.—Vesicular goitre in a Langley Mill (Heanor) woman.

low endemicity, it is commoner in females than in males. In early cases, there is a marked tendency towards spontaneous disappearance of the disease.

Vesicular goitre.—In the progressive stage there is a general and uniform bilateral enlargement of the thyroid gland. Vesiculated colloid is seen and *secretory tissue is entirely absent.* It is found in the newborn of goitrous mothers, in cretins or cretinoid infants. It is not found after eighteen years of age.

In the retrogressive stage which is commonly encountered and may arise at any age, there are two forms which differ only in the size of the gland units in which the cyst formation occurs. In the one, each vesicle has become a cyst of small size in the other there is coalescence of vesicles within the limits of a lobule to form a larger cyst.

The major incidence of vesicular goitre is 11-14 years. At this age the average thyroid gland is actively secretory with a diminution of stored colloid and the condition is thus a wide departure from the normal (Williamson and Pearse [9]).

Lymphadenoid goitre.—This is described as a physiological insufficiency, a hypertrophic reaction with preponderance of lymphocytic aggregates, fibrosis, and a peculiar atrophy of the parenchyma. Clinically, it is associated with myxœdema. The condition can be focal and non-goitrous. It is described in the literature as "woody thyroid," Reidel's thyroid, sarcoma, endothelioma, and, lymphosarcoma.

VI.

Causes of Simple Goitre.

(1) *Influence of iodine content of soils and water.*—No attempts have hitherto been made to estimate the iodine content of Derbyshire drinking waters and soils. It has been declared that, on account of the distance from the sea and the direction of the prevailing winds, that they could contain none. The source of iodine is the land, not the sea.

Hehner, in 1876, found iodine in the Buxton Mineral Spring waters, and in 1924 Mr. Race found 4·4 parts per billion in the same waters. Estimations of the iodine content of Derbyshire foodstuffs were published by Orr [11]. The results obtained were inconclusive for "there is no indication whatever of any difference between those areas in England which were reported to have a low goitre incidence and those reported to have a high goitre incidence."

The water supplies of Derbyshire are obtained from very varied sources but can be classified as being [1] surface supplies from upland gathering grounds, and [2] underground sources such as surface wells, springs, deep springs and bores.

The results obtained (Tables XI and XII, pp. 70, 71) indicate that there is no definite correlation between the iodine content of drinking waters or soils and the incidence of goitre in this county. Orr [11] stated that "at present, no correlation between the level of iodine in drinking-water in this country and the incidence of endemic goitre has been made out." The same conclusion was drawn by Taylor [12].

Four samples of Derbyshire drinking waters were examined by the Rowett Research Institute, Aberdeen, in 1926-7. The results obtained by them did not indicate any connection between the iodine content of the water and the goitre incidence in the areas served by these water supplies. Melbourne and Long Eaton with 8·0% of goitre, Heanor and Ilkeston with 33·0% of goitre (all thyroid enlargements), Wirksworth with 8·1% of goitre and Ashbourne with 3·8% of goitre had in their respective supplies at that time in terms of iodine as γ per litre, 1·66, 2·10, 1·87 and 1·84. (Table XI, p. 70.)

If iodine insufficiency were the *sole* cause of childhood goitre in this county then the administration of the element should produce very appreciable results. In 1925,

some experiments were instituted at Heanor. They consisted of giving each child 1/10th of a grain of iodine a week in the form of sodium iodide. The public water supply was iodized by the addition of sodium iodide in such an amount that, assuming a person consumed four pints of water a day, he would receive in the course of a year 14·9 mgm. of sodium iodide. During the period the children were given iodized sweets, the whole population had the iodized water. The results obtained were not such as to encourage us very much. No decrease in the incidence of thyroid enlargement was observed in the course of ten to eleven months in any series receiving either iodized water alone or iodized water plus iodized sweets. The results were as follows:—

ALL THYROID ENLARGEMENTS.

(1)	Girls 9-14 years	26. 2.25 10.12.25	24·5% 66·9%	Iodized sweets and water.
(2)	Girls 5-10 years	27. 2.25 11.12.25	29·6% 42·3%	Iodized water.
(3)	Boys 5-7 years	27. 2.25 11.12.25	18·6% 26·0%	Iodized water.
(4)	Girls 7-14 years	Feb., 1925 Jan., 1926	46·8% 51·5%	Iodized sweets, 1925, first half, second half, iodized water.
(5)	Girls 10-18 years	Mar., 1925 Dec., 1925	41·3% 64·8%	Iodized sweets, 1925, second half. Mostly iodized water.

A further series of experiments was commenced in 1926. Although no good was done by the previous series, no harm was observed to have taken place. These results i.e., of the second series, have been published elsewhere [13]. The results obtained were not statistically significant in favour of either prevention or treatment of childhood goitre with iodine in this district. The conclusion we came to was that, in this area, normal children were better without iodine at all, and, that whatever the cause of goitre in them may have been, iodine deficiency was not the sole cause. These experiments have been criticized by Orr and Leitch on the ground that the period of treatment was too short to allow of definite conclusions, and that I failed to take account sufficiently that many of the cases treated were at an age when the goitrous gland is rapidly increasing in size. They forget or did not know that this was the second series of experiments on iodine prophylaxis with iodized sweets. The results we got did not justify further expenditure of public funds on a procedure so unproductive of beneficial results, whilst, at the same time leaving the much more important matter of the state of the water supply alone. Whatever the results obtained in other places, ours did not correspond with theirs. At Rochester, U.S.A., it was claimed that a yearly dose of 7·5 mgm. of sodium iodide would reduce the goitre incidence by 50 per cent. The dose we gave in the water was double that. It is not often stated that in the following year the Rochester figures increased from 1,766 to 2,010 in spite of the continuation of the iodizing of their water supply [15].

In speaking of the iodine question, Williamson and Pearse [10] said: "If lack of iodine gives rise to goitre, it cannot give rise to the hypertrophic form of goitre. It is not possible to conceive a productive hypertrophy arising from the absence of the essential element that is to be produced by that hypertrophy. You cannot make bricks without straw. Thus, whatever theory is adopted, it is evident that the hypertrophic endemic goitre must not be stimulated by the administration of iodine. The risk of inducing the pathological condition of secondary Graves' disease is considerable. Iodine Basedowii is the term given to this clinically well-recognized misapplication of iodine therapy to hypertrophy of the thyroid gland. . . . In the light of our present knowledge, or want of knowledge, we must postulate that the continuous use of iodine can do nothing but harm to the critically balanced hypertrophic goitre in the young. The hypertrophy probably is an adjustment of the

differentiating individual to his environment. We should not meddle with this adjustment. We must look rather for the cause of the hypertrophy, which we have seen is just as likely to be too much as too little iodine."

With colloid goitre it is a different matter, but even in this type there is no deficiency of iodine in the gland. In the dog's thyroid you can see the iodine content of the dried thyroid was 0·267%, a high content. In this type the iodine appears to be in some way locked up in the gland. Excess of calcium, especially in certain circumstances, is certainly involved in the production of this type. At any rate, it is the only type of simple goitre which is amenable to iodine therapy. There is no case made out in my submission for the promiscuous administration of iodine amongst either the children or adult population of this county.

(2) *Influence of ill-balanced diets.*—In the early part of last century Dr. Good maintained that goitre was due to the prevalence of subsisting largely upon oatmeal made from corn grown on the local soil.

In 1911, Dr. Ogilvie of Fauldhouse [16], after a careful inquiry into the prevalence of goitre in that area, concluded: "I am convinced that the great increase in the number of cases of this disease, which we know has prevailed for some considerable time, is due to some striking cause. . . . I think it is more likely to be due to the great change in the mode of living which took place among the inhabitants a year or two ago. Before this time you had the mining classes partaking of a rich dietary as far as that goes among the mining classes. You found large quantities of butcher meat, cheese, butter and eggs being consumed, but, on account of the acute depression in the coal trade there was a keen struggle for existence, and in the place of the substantial diet afore-mentioned there was among many substituted one of the most meagre description."

Stiner [17] produced goitre in animals fed on scorbutic diets, and he believed that the prevalent use of white fine flour had some ætiologic relation to the onset of goitre. Animals fed on ill-balanced diets, and kept in unhealthy surroundings, are very liable to develop goitre. This is one of the pitfalls in goitre research; well do I know it.

The lymph-adenoid type of goitre is certainly not related to deficiency of iodine. This type is very definitely related to conditions of diet deficient in vitamins A, B and C, from which green vegetables and fruit are excluded, and containing more than 60 per cent. of white flour or vitamin-poor carbohydrate, 20% or less of protein, 8% to 10% of vitamin-poor fats, and inorganic salts (including iodine) in adequate amounts [18].

The chief faults noted in the diets of goitrous Derbyshire children are often a total absence of fresh vegetables and fruit, the substitution of butter by margarine or vitamin-poor fats, far too much reliance upon white bread, and an insufficiency of meat. Milk is an article of diet consumed sparingly by many.

Goitre has often been remarked upon by doctors to me as being a "poor man's disease." Rather, we should say it may be, at least in some aspects, a disease of ignorant persons. An improperly balanced diet is a much more important factor in the genesis of thyroid disease than was formerly supposed. Not only is it related to vitamin imbalance or deficiency, but also to mineral imbalance between calcium, phosphorus and iodine. There is also evidence that positive goitrogenic substances exist in certain foods. To consider the relation of diet from the view-point of iodine deficiency alone is much too narrow, and leads only to the greatest confusion.

As an illustration of the effect of diet upon the incidence of goitre in Derbyshire I may give the example of Wirksworth. At the Council School the children come from good-class homes, are well nourished and cared for. The goitre incidence in them was 2·9%. At the Church School where the children were of a very different order and of a much inferior type, the incidence of goitre was 15%. There is nothing to explain the difference except very material social conditions.

(3) *Influence of water supply.*—There is a good deal of evidence in Derbyshire to support the view that drinking water is a powerful agency in the production of the disease. Goitre has either diminished or disappeared in many places following the introduction of better water supplies. There are numerous instances of this occurring in the county. There was a time when almost every person in Beeley had goitre. At that time the people obtained their water from Beeley brook, and there was a tradition that whoever drank the water from this stream would get a "thick neck." The neighbouring town of Bakewell was also very goitrous many years ago. The introduction of a new supply from Fallinge Moor which supplies both Bakewell and Beeley was followed by a great diminution in the incidence of the disease in both places. There is no native case of goitre in Bakewell at the present time. Ashford, Baslow, Cromford, Matlock, and Youlgreave have all been centres of goitre. There is very little to be found there now. This, again, occurred following on the introduction of improved water supplies—chiefly from the neighbouring Millstone Grit. Where two sources of water supply are in existence, it is common to find that one is goitre free and the other associated with goitre. For example, at Linton, part of the village has shallow wells, part is supplied by the South Staffordshire Water Company. Of the goitres seen at that place, 61% were associated with those drinking well water, and of these all the large goitres were similarly associated. At Ashover the village has a good supply: the children attending the school come from a scattered area. On two occasions when I examined them I found that 84% and 72% of the goitres were in those who obtained water from shallow wells and other dubious sources.

Heanor and Ilkeston obtain water from deep springs in the Limestone. Some years ago, this supply was seriously polluted. The methods of treating the raw water were inadequate. In 1924, the Heanor district was affected considerably. Between the ages of 5-14 years, 36·6% of girls and 32·7% of boys showed definite signs of thyroid enlargement. The incidence in women aged 14-40 years was 50·6% and in men it was 12·0%. The present state of goitre in this locality is 9·0% for the children in the same age-group for all degrees of thyroid enlargement. It is difficult to find any cases in adults. It is a long time since I had a case to treat of recent origin. There has been no change in the habits of the people, but very material improvements have taken place in the state of the water supply. They may be summarized as follows:—

1902 to June, 1924	Archbutt-Deely intermittent plant in use for softening. Sedimentation and carbonation with carbon dioxide.
June, 1924 ...	Automatic syphonic continuous softening plant installed. Produced softer water and suspended lime after sedimentation lessened by 40% to 50%.
December, 1924 ...	Intermittent chlorination commenced when bacterial count became high.
August, 1925 ...	No. 1 Filter completed.
July, 1926 ...	Borehole completed. Three parts of this mixed with seven parts of raw sough water.
April, 1927 ...	No. 3 Filter completed.
February, 1928 ...	No. 4 Filter completed.
1929	Nos. 5 and 6 Filters completed.
1930 to 1931 ...	Nos. 7 to 14 Filters completed.

Each filter deals with 10,000 gallons per hour. Continuous chlorination after filtration has been done for a considerable time. The softening plant reduces the total hardness of the raw water from 22° to 8·5° (Clark). In 1930, the raw

sough water contained *B. coli* in from 1 to 0·1 c.c.—a very dangerous and heavy pollution.

It is since the water has been efficiently filtered and continuously chlorinated that we in Heanor have experienced so marked a reduction in the incidence of goitre. The iodization of the water was stopped in 1926. If there was any exciting cause it was not iodine deficiency: it was much more likely to be attributed to the condition of this public supply at that time.

With regard to the calcareous nature of water, whether in suspension or solution [19], being the cause of goitre, Sir James Berry has observed that in many goitrous localities calcareous matter in a very fine state of division is to be found in the water supplies. At the time when goitre was common in Heanor there was certainly a great deal of suspended calcareous matter in the treated water. But I must point out that the reduction in the incidence of goitre followed the removal not only of calcareous suspended matter, but also that of noxious animal matter. Moreover, if the calcareous content of drinking water, either in suspension or solution, is the sole cause of goitre, it is difficult to understand why the incidence of goitre in the Permian, Keuper and Bunter regions of Derbyshire should so closely resemble the incidence seen in the regions supplied from upland surface supplies (e.g., Chesterfield R.D.C.—north and south—and the Derwent Valley Water Board).

That calcium excess does play some part in the production of colloid goitre there is no doubt, but it appears that imbalance of calcium and phosphorus, or imbalance between calcium, phosphorus and iodine is responsible [20]. "The effect of lime is to cause colloid material to accumulate in the vesicles of the thyroid gland; an effect which the administration of iodine prevents. It is possible that sodium phosphate may act in a similar way, but it is more likely that its addition to the diet containing an excess of lime prevents the absorption into the system of an excess of lime by its combination with the latter to form insoluble calcium phosphate in the bowel." [21].

The only colloid goitre I have produced experimentally was obtained in a male dog by the administration of sterilized calcareous deposit from the sedimentation tanks of the Heanor and Ilkeston waterworks. This goitre developed in sixteen days from the onset of the experiment.

VII.

Conclusions.

In conclusion, the cause of "endemic goitre" in Derbyshire is not to be regarded as being any single agent. One must recognize that impure and unprotected sources of water supply, leading to gastro-intestinal infection, possibly of a specific kind, play a large part and have played a large part in past times in the production of the disease. But there are so many variations within the same region of supply that it is certain that there are other factors in operation, apart from any question of puberty or sex. Food supply in relation to mineral imbalance, deficiency of iodine, or of vitamin content all no doubt play their part. Simple goitre is a misnomer: the problem of causation is by no means simple.

I have indicated as efficiently as I can the distribution of childhood goitre of any degree worthy of the name. I leave it to others to solve the problem of the very definite relationship between goitre in the limestone region and the almost total absence of the disease in the triassic region in the south. So far as I have been able to go there is no evidence that iodine insufficiency is, or has been, a principal factor in the genesis of the disease in this county.

I can do no better than quote Sir James Berry, who said, in 1901, "But, although goitre in most cases is to be regarded as an endemic disease, caused by

a definite poison, whatever that poison may be, it is impossible to assert that all cases of goitre originate from the same cause." Attention to the principles of public and personal hygiene and sanitation, the principles of nutrition, the substitution of good water supplies in place of those of great impurity, both as regards their mineral and animal content, have all played a large part in abolishing or greatly diminishing our very old friend the Derby-Neck.

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APPENDIX.

Method of Iodine Estimation Employed.

Soil.—Take 50 grams of dried, powdered, and sifted soil, macerate with excess of strong potassium hydroxide. Dry, and then pulverize. Ignite in nickel crucible at a low red heat to destroy organic matter. Transfer contents to a beaker and wash out the crucible. Wash the contents of the beaker with successive quantities of 50 c.c. each of boiling water, allowing the residue to settle after each washing and decanting the supernatant liquor through a filter paper. After several washings, transfer the residue on to the filter paper and pass sufficient hot water through the filter paper to make up to about 250 c.c. To the filtrate add 10 c.c. of chlorinated soda and then phosphoric acid (S.G. 1·75), diluted with an equal amount of water, until a permanent yellow colour is obtained; then add a further 5 c.c. of diluted phosphoric acid. Boil until the volume of the liquid is reduced to about 50 c.c. and then add 50 c.c. of distilled water and boil for a further fifteen minutes. Cool, add 10 c.c. of a 1·0% solution or a small crystal of potassium iodide, and estimate the amount of liberated iodine by titration with freshly prepared N/1270 thiosulphate of soda, and a freshly prepared solution of soluble starch as indicator.

$$\left.\begin{matrix}\text{Parts of iodine per}\\ \text{10 million } (10^7)\end{matrix}\right\} = \frac{\text{c.c. Thiosulph.}}{6} \times \frac{0{\cdot}0001 \times 10{,}000{,}000}{50} = \text{c.c. N/1270 thiosulphate} \times 3{\cdot}33.$$

Water.—5 to 10 litres of water is taken according to origin, evaporated to dryness after addition of sufficient potassium carbonate to make it pink to phenolphthalein. The residue is then powdered and mixed with two to three times its bulk of fusion

mixture, and fused in a platinum dish at low red heat. The mass is dissolved in distilled water, and the solution then treated as the filtrate in the case of soils.

It is not contended that this method will give absolute amounts of iodine either in soil or water, but in the hands of different workers, identical samples give very similar results. A good many soils have been examined in duplicate by myself and also by Messrs. Boots, of Nottingham. The results show that for *comparative* purposes the method is sufficiently accurate.

COMPARATIVE RESULTS OF SOIL ANALYSIS FOR IODINE CONTENT.

	Parts per 10 million (10^7)				
No.	Boots	Turton	Newcomb	Nath	Norris
1	5·0 3·3	—	—	—	—
2	65·0 63·0	—	—	—	—
3	8·7 8·0	—	—	—	—
4	6·6 5·3	—	—	—	—
5	123·0 113·0	—	—	—	—
6	3·0 3·0	—	—	—	—
7	15·0 14·0	—	—	—	—
8	42·0	41·0 40·6	243	262	300
9	12·3	7·9 5·9	35	22	30
10	14 6	9·3 5·3	45	34	10
11	—	5·9 5·4	5	5	0
12	—	5·3 4·8	5	2	10
13	—	2·7 2·7	15	5	0
14	—	2·7 2·0	0	Traces	0
15	—	4·0 5·6	0	2	0
16	—	6·6 5·9	8	5	—

Samples Nos. 8 to 16 were sent to me by Colonel Sir R. McCarrison. The iodine content of these had previously been determined by Newcomb, Nath and Norris independently of each other. The origin of these samples and the results obtained were not communicated to us until our results had been received in India. No. 8 came from Coonoor, No. 9 from Sanawar, No. 10 from Kasauli, No. 11 from Gilgit, No. 13 from Barmis, No. 14 from Kashrote, No. 15 from Basin and No. 16 from Miragram. (See "Etiology of Endemic Goitre," R. McCarrison, pp. 73-78).

The method employed by us differed from those used by Newcomb and his co-workers. No. 8 is the only one where there appears to be any great discrepancy between our results and theirs, but it will be seen that our own results on this sample closely correspond. The estimation of soil and water iodine is a matter of great difficulty and it must not be forgotten that the results are recorded in terms of parts per ten-million. Iodine loss is most likely to occur during the ignition or fusion stage. To minimize loss, the temperature should not exceed 400° C., and the period of ignition should be as short as possible. It is also important to use sufficient potassium hydroxide.

TABLE I.—SHOWING PERCENTAGE INCIDENCE OF GOITRE IN CHILDREN IN AREAS DERIVING WATER SUPPLY FROM THE LIMESTONE.

	Place	Degree of Goitre per cent. ** or over	*** or over
	Alsop, Cold Eaton, Friden, Hartington Moor, Heathcote, Newhaven, Pikehall	14·2	Nil
	Bradbourne	5·5	Nil
	Brassington	14·0	4·7
	Bonsall	3·2	0·8
	Carsington	35·9	21·4
	Chelmorton	6·2	Nil
	Cressbrook	3·7	Nil
	Flagg	11·1	Nil
	Hartington	11·3	2·3
Heanor and Ilkeston supply	Heanor (1931)	5·8	2·8
	Ilkeston (1928)	4·1	0·8
	Ironville (1931)	1·8	Nil
	Kirk Hallam (1931)	Nil	Nil
	Shipley (1927)	23·0	5·3
	Stanton-by-Dale (1931)	3·7	1·8
	*Average for supply	5·4	1·9
	Kingsterndale	Nil	Nil
	Middleton-by-Wirksworth	12·7	1·8
	Middleton-by-Youlgreave	14·0	7·0
	Monyash	11·4	Nil
	Over Haddon	5·0	Nil
	Parwich	25·8	12·9
	Peak Forest	2·3	2·3
	Sheldon	6·6	Nil
	Taddington	4·4	Nil
	Tideswell and Litton	6·3	2·8
	Tissington	8·3	Nil
	Wormhill	9·1	Nil

*NOTE.—1924 survey of Heanor not included. 36·6 per cent. girls, 32·7 per cent. boys goitrous (all thyroid enlargements).

TABLE Ia.—SHOWING AGE AND SEX DISTRIBUTION OF GOITRE IN AREAS DERIVING WATER SUPPLY FROM THE LIMESTONE.

Age	Number examined	Degree of Goitre *	**	*** or over	Total
	Girls.				
13	264	24	24	19	67
12	233	19	24	9	52
11	301	26	20	12	58
10	263	15	14	2	31
9	278	21	17	1	39
8	217	12	7	1	20
Total	1,556	117	106	44	267
	Boys.				
13	244	11	8	7	26
12	244	18	4	5	27
11	275	19	10	4	33
10	340	16	9	4	29
9	281	12	4	4	20
8	224	15	2	1	18
Total	1,608	91	37	25	153

Total examined = 3,164

Goitrous ** or over = 6·7 per cent.
*** or over = 2·2 per cent.

TABLE II.—SHOWING PERCENTAGE INCIDENCE OF GOITRE IN CHILDREN IN AREAS DERIVING WATER SUPPLY FROM LIMESTONE SHALES.

Place	Degree of Goitre per cent. ** or over	*** or over
Bamford	3·3	Nil
Bradley	5·2	5·2
Bradwell	5·6	3·7
Castleton	6·5	2·3
Edale	12·0	Nil
Elton	15·1	3·0
Eyam	9·6	2·4
Fenny Bentley	11·5	3·8
Great Hucklow	11·1	3·7
Great Rowsley	1·8	Nil
Hognaston	17·2	6·9
Idridgehay...	Nil	Nil
Kirk Ireton	2·8	Nil
Kniveton	2·7	Nil
Turnditch	Nil	Nil

TABLE IIa.—SHOWING AGE AND SEX DISTRIBUTION OF GOITRE IN AREAS DERIVING WATER SUPPLY FROM LIMESTONE SHALES.

Girls.

Age	Number examined	*	Degree of Goitre **	*** or over	Total
13	60	11	7	2	20
12	62	6	5	5	16
11	42	8	3	2	13
10	72	5	2	1	8
9	53	6	2	0	8
8	42	2	1	0	3
Total	331	38	20	10	68

Boys.

13	47	4	3	1	8
12	49	3	2	0	5
11	57	1	3	1	5
10	45	3	0	0	3
9	57	7	1	0	8
8	32	2	0	0	2
Total	287	20	9	2	31

Total examined = 618

Goitrous ** or over = 6·6 per cent.
*** or over = 1·9 per cent.

TABLE III.—SHOWING PERCENTAGE INCIDENCE OF GOITRE IN CHILDREN IN AREAS DERIVING WATER SUPPLY FROM MILLSTONE GRIT.

Place	Degree of Goitre per cent. ** or over	*** or over
Alderwasley	Nil	Nil
Alfreton	6·4	2·0
Brackenfield	Nil	Nil
Riddings	4·4	1·8
Swanwick	3·4	0·4
Somercotes	4·0	1·6
Average Alfreton U.D. supply	4·8	1·6
Ashover	6·1	2·2

TABLE III—(*continued*).

Place	Degree of Goitre per cent. ** or over	*** or over
Bakewell	2·7	0·6
Beeley	7·1	3·5
Average Bakewell U.D. supply	3·3	1·4
Baslow	6·3	Nil
Ambergate	4·6	1·5
Belper	5·9	0·3
Denby	3·6	1·8
Denby Smithy Houses	4·6	Nil
Hartshay	7·4	2·4
Heage	3·2	1·4
Nether Heage	Nil	Nil
Holbrook	2·3	0·7
Horsley	4·1	Nil
Horsley Woodhouse and Smalley	6·8	0·6
Kilburn	4·5	Nil
Milford	1·9	Nil
Pentrich	Nil	Nil
Average Belper U.D. supply	4·2	0·8
Bugsworth	1·9	0·9
Chapel-en-le-Frith	Nil	Nil
Charlesworth	Nil	Nil
Chinley	1·2	Nil
Clay Cross	2·8	0·3
Crich	5·8	Nil
Dethick, Lea, and Holloway	7·0	3·0
Fritchley	12·5	2·7
South Wingfield	0·7	0·7
Whatstandwell	4·0	Nil
Average for Crich supply	5·0	1·2
Cromford	5·8	1·4
Curbar	10·5	5·2
Derwent	Nil	Nil
Dove-Holes	5·2	1·0
Eyam Woodlands	Nil	Nil
Hathersage	9·9	Nil
Hayfield	4·0	1·5
Hazlewood	6·6	3·3
Hope	3·2	1·6
Hopton	33·3	Nil
Draycott	6·1	0·9
Long Eaton	8·1	1·0
Melbourne	10·5	1·0
Sawley	1·9	1·9
Stanton by Bridge	1·4	Nil
Average for Long Eaton U.D. supply	8·0	1·1
Matlock	4·5	0·5
Matlock Bath	7·2	1·8
North Darley	Nil	Nil
Pilsley (Bakewell)	6·9	Nil
South Darley	Nil	Nil
Stanton in the Peak	19·5	7·3
Ashford	2·5	2·5
Calver	25·0	10·7
Froggart	Nil	Nil
Great Longstone	5·4	Nil
Stony Middleton	11·7	1·9
Average for Stoke Flats Scheme	9·5	3·0
Tansley	1·3	Nil
Winster	3·7	Nil
Wirksworth	8·1	2·9
Youlgreave	5·0	1·3

TABLE IIIa.—SHOWING AGE AND SEX DISTRIBUTION OF GOITRE IN AREAS DERIVING WATER SUPPLY FROM MILLSTONE GRIT.

Girls.

Age	Number examined	Degree of Goitre *	**	*** or over	Total
13	762	95	57	35	187
12	781	88	50	30	168
11	791	80	54	15	149
10	741	75	42	4	121
9	766	71	24	6	101
8	685	59	11	3	73
Total	4,526	468	238	93	799

Boys.

13	813	65	32	12	109
12	701	64	28	2	94
11	812	55	18	7	80
10	822	67	8	1	76
9	761	50	15	1	66
8	688	43	8	0	51
Total	4,597	344	109	23	476

Total examined = 9,123.

Goitrous ** or over = 5·1 per cent.
*** or over = 1·27 per cent.

TABLE IV.—SHOWING PERCENTAGE INCIDENCE OF GOITRE IN CHILDREN IN AREAS DERIVING WATER SUPPLY FROM COAL MEASURES.

Place	Degree of Goitre per cent. ** or over	*** or over
Chisworth	Nil	Nil
Dale Abbey	2·7	Nil
Hardstoft	Nil	Nil
Marple Bridge } Ludworth }	1·3	Nil
Mapperley	18·8	Nil
Stanley	10·8	Nil
Stanley Common	6·4	1·6
West Hallam	5·9	1·9
Average for Mapperley Colliery supply	9·7	1·0
Mellor	Nil	Nil
Pinxton	5·0	2·4
Stainsby	11·1	Nil

TABLE IVa.—SHOWING AGE AND SEX DISTRIBUTION OF GOITRE IN AREAS DERIVING WATER SUPPLY FROM COAL MEASURES.

Girls.

Age	Number examined	Degree of Goitre *	**	*** or over	Total
13	91	15	4	3	22
12	78	14	7	3	24
11	84	7	3	1	11
10	101	9	3	2	14
9	100	8	3	0	11
8	94	6	1	0	7
Total	548	59	21	9	89

Boys.

13	84	5	5	3	13
12	61	7	5	1	13
11	107	7	4	2	13
10	111	15	5	0	20
9	80	9	3	1	13
8	78	6	2	1	9
Total	521	49	24	8	81

Total examined = 1,069

Goitrous ** or over = 5·8 per cent.
*** or over = 1·6 per cent.

TABLE V.—SHOWING PERCENTAGE INCIDENCE OF GOITRE IN CHILDREN IN AREAS DERIVING WATER SUPPLY FROM MAGNESIAN LIMESTONE.

Place	Degree of Goitre per cent. ** or over	*** or over
Bolsover	5·9	1·0
Palterton	19·5	4·3
Scarcliffe	7·5	1·8
Upper Langwith	3·9	2·6
Average for Bolsover U.D. Supply	6·6	1·7
Barlborough	0·7	Nil
Clown	1·6	0·7
Cresswell	1·3	Nil
Whitwell	2·0	0·5
Average for Clown R.D.C. Supply	1·5	0·4
Doe Lea	2·1	0·4
Pleasley	1·4	0·3
Rowthorne	Nil	Nil
Shirebrook	1·8	0·6
Blackwell	2·6	0·7
South Normanton	2·2	0·5
Average for Sutton-in-Ashfield (Notts.) Supply ..	2·3	0·6

TABLE Va.—SHOWING AGE AND SEX DISTRIBUTION OF GOITRE IN AREAS DERIVING WATER SUPPLY FROM THE PERMIAN.

Age	Number examined		Degree of Goitre **	*** or over	Total
Girls.					
13	369	33	16	11	60
12	359	31	10	8	49
11	396	22	13	7	42
10	390	19	5	3	27
9	349	9	6	0	15
8	413	16	5	0	21
Total	2,276	130	55	29	214
Boys.					
13	403	19	3	1	23
12	366	15	6	0	21
11	398	17	6	1	24
10	399	21	7	1	29
9	403	10	5	0	15
8	311	9	2	0	11
Total	2,280	91	29	3	123

Total examined = 4,556

Goitrous ** or over = 2·5 per cent.

*** or over = 0·7 per cent.

TABLE VI.—SHOWING PERCENTAGE INCIDENCE OF GOITRE IN CHILDREN IN AREAS DERIVING WATER SUPPLY FROM THE BUNTER.

Place	Degree of Goitre per cent. ** or over	*** or over
Ashbourne...	3·8	Nil
Duffield	5·8	3·9
Edlaston	4·8	Nil
Hulland	5·0	5·0
Mackworth	Nil	Nil
Morley	12·0	Nil
Muggington, Mercaston, Weston Underwood ...	2·8	Nil
Netherseal...	4·2	1·4
Quarndon	Nil	Nil
Repton	1·8	Nil
Sandiacre	2·6	1·1
Risley	Nil	Nil
Average for Sandiacre Supply	2·4	0·9
Swadlincote	1·3	0·5
Tibshelf	1·5	0·7

TABLE VIa.—SHOWING AGE AND SEX DISTRIBUTION OF GOITRE IN AREAS DERIVING WATER SUPPLY FROM THE BUNTER SANDSTONE.

Age	Number examined	Degree of Goitre *	**	*** or over	Total
Girls.					
13	226	14	10	8	32
12	238	11	6	5	22
11	218	10	4	2	16
10	241	15	6	0	21
9	244	9	2	0	11
8	243	10	1	2	13
Total	1,410	69	29	17	115
Boys.					
13	281	12	3	2	17
12	242	11	4	0	15
11	261	13	1	2	16
10	218	5	2	0	7
9	252	12	1	2	15
8	248	5	0	0	5
Total	1,502	58	11	6	75

Total examined = 2,912

Goitrous. ** or over = 2·2 per cent.
*** or over = 0·78 per cent.

TABLE VII.—SHOWING PERCENTAGE INCIDENCE OF GOITRE IN CHILDREN IN AREAS DERIVING WATER SUPPLY FROM KEUPER MARLS.

Place	Degree of Goitre per cent. ** or over	*** or over
Allestree	7·0	Nil
Aston-on-Trent	Nil	Nil
Barrow-on-Trent	Nil	Nil
Boylestone	5·2	Nil
Bretby	Nil	Nil
Chaddesden	10·6	4·0
Chellaston	5·0	Nil
Church Broughton	4·0	Nil
Coton-in-the-Elms	2·6	1·3
Cubley	2·2	Nil
Darley Abbey	1·7	Nil
Eggington	Nil	Nil
Elvaston and Thulston	3·0	Nil
Etwall	7·9	1·6
Findern	3·1	Nil
Foston and Scropton	4·5	Nil
Hartshorn	3·2	0·8
Hatton	2·0	Nil
Hilton	4·0	1·3
Kirk Langley	2·3	Nil
Linton and Castle Gresley	2·6	1·0
Longford	Nil	Nil
Lullington	9·0	Nil
Marston Montgomery	7·5	Nil
Mickleover	6·2	0·7
Newton Solney	5·0	Nil
Osliston and Thurvaston	3·2	3·2
Overseal	1·9	0·7
Radbourne	Nil	Nil
Rosliston	3·5	3·5
Shardlow	2·5	Nil
Shirley	3·7	Nil
Smisby	2·7	Nil
Sutton-on-the-Hill	Nil	Nil
Ticknall	17·3	1·3
Twyford	11·1	5·5
Walton-on-Trent	2·1	Nil
Weston-on-Trent	Nil	Nil
Willington	1·7	Nil
Woodville	2·7	0·8
Yeaveley	6·6	Nil

TABLE VIIa.—SHOWING AGE AND SEX DISTRIBUTION OF GOITRE IN AREAS DERIVING WATER SUPPLY FROM THE KEUPER.

Girls.

Age	Number examined	Degree of Goitre *	**	*** or over	Total
13	246	23	15	11	49
12	213	21	12	5	38
11	253	26	11	2	39
10	233	23	11	2	36
9	261	16	3	1	20
8	239	10	5	0	15
Total	1,445	119	57	21	197

Boys.

13	222	14	8	3	25
12	228	12	8	0	20
11	259	7	5	0	12
10	249	15	6	0	21
9	237	8	3	0	11
8	271	14	0	0	14
Total	1,466	70	30	3	103

Total examined = 2,911

Goitrous ** or over = 3·9 per cent.
*** or over = 0·8 per cent.

TABLE VIII.—SHOWING PERCENTAGE INCIDENCE OF GOITRE IN CHILDREN IN AREAS DERIVING WATER SUPPLY FROM GLACIAL SAND AND GRAVEL. (PLEISTOCENE.)

Place	Degree of Goitre per cent. ** or over	*** or over
Brailsford	3·0	1·5
Clifton	Nil	Nil
Doveridge	5·2	Nil
Norbury	5·9	2·9
Osmaston	Nil	Nil
Sudbury	1·6	Nil

TABLE VIIIa.—SHOWING AGE AND SEX DISTRIBUTION OF GOITRE IN AREAS DERIVING WATER SUPPLY FROM PLEISTOCENE.

Girls.

Age	Number examined	Degree of Goitre *	**	*** or over	Total
13	24	3	3	1	7
12	27	5	1	0	6
11	25	5	0	1	6
10	30	2	0	0	2
9	11	1	1	0	2
8	15	1	0	0	1
Total	132	17	5	2	24

Boys.

13	31	1	1	0	2
12	22	1	0	0	1
11	28	0	0	0	0
10	20	2	0	0	2
9	27	1	0	0	1
8	25	2	0	0	2
Total	153	7	1	0	8

Total examined = 285

Goitrous ** or over = 2·8 per cent.
*** or over = 0·7 per cent.

TABLE IX.—SHOWING PERCENTAGE INCIDENCE OF GOITRE IN CHILDREN IN AREAS DERIVING WATER-SUPPLY FROM SURFACE SUPPLIES (UPLAND SOURCES).

Place	Degree of Goitre per cent. ** or over	*** or over
Buxton	3·2	Nil
Brimington	1·4	0·7
Calow	3·3	0·8
Wingerworth	1·8	Nil
Chesterfield	5·3	1·3
Hasland	3·2	0·8
Old Whittington	3·1	0·8
New Whittington	3·0	0·3
Wigley	2·8	Nil
Cutthorpe	1·4	Nil
Grassmoor	1·0	0·2
Average for Chesterfield Borough Supply	2·6	0·7
Holmesfield	8·8	4·4
Barlow	1·1	Nil
Dronfield Woodhouse	8·1	1·1
Coal Aston	Nil	Nil
Unstone	6·0	2·2
Eckington	2·6	0·9
,, Renishaw	3·7	1·8
,, Mosboro'	3·1	0·9
Beighton	1·7	0·6
Killamarsh	3·3	0·5
Staveley	2·6	0·4
,, Barrowhill	3·0	0·5
,, Mastin Moor	5·8	4·1
Sutton-cum-Duckmanton	4·9	2·4
Average for Chesterfield R.D.C. Supply. Northern Scheme	3·0	1·0
Dronfield	3·8	2·0
Heath	1·8	0·2
Morton	3·7	0·9
North Wingfield	0·8	Nil
Pilsley	2·5	0·7
Shirland and Higham	7·7	2·2
Stonebroom	5·2	0·9
Temple Normanton	3·6	0·7
Tupton	1·6	0·5
Wessington	2·9	Nil
Average for Chesterfield R.D.C. Supply. Southern Scheme	3·1	0·9
Derby Borough Supply	1·7	0·5
Breaston	2·9	Nil
Ripley	4·6	1·5
Borrowash	Nil	Nil
Average for Derwent Valley Water Board Supply	4·2	1·2
Earl Sterndale	3·1	Nil
Glossop	2·8	0·8
Biggin (Hartington Nether Quarter)	Nil	Nil
New Mills	3·6	Nil
Thornsett	4·8	1·8
Average for New Mills U.D. Supply	4·0	0·6
Dore	1·3	1·3
Norton	1·6	Nil
Totley	1·9	0·9
Average for Sheffield Corporation Supply	1·6	1·8
Wardlow	4·0	Nil

TABLE IXa.—SHOWING AGE AND SEX DISTRIBUTION OF GOITRE IN AREAS DERIVING WATER SUPPLY FROM SURFACE SUPPLIES.

Age	Number examined	Degree of Goitre *	**	*** or over	Total
	Girls.				
13	1,395	139	69	44	252
12	1,296	132	56	26	214
11	1,332	106	36	13	155
10	1,245	95	25	5	125
9	1,250	75	14	1	90
8	1,332	69	7	2	78
Total	7,850	616	207	91	914
	Boys.				
13	1,492	102	28	15	145
12	1,261	91	31	8	130
11	1,151	82	11	5	98
10	1,216	58	15	3	76
9	1,225	55	12	1	68
8	1,211	39	8	0	47
Total	7,556	427	105	32	564

Total examined = 15,406

Goitrous ** or over = 2·8 per cent.
*** or over = 0·8 per cent.

TABLE X.—SHOWING DISTRIBUTION OF GOITRE IN DERBYSHIRE CHILDREN ACCORDING TO THE GEOLOGICAL ORIGIN OF THE WATER SUPPLY.

	Geological formation	Degree of Goitre per cent. ** or over	*** or over
Carboniferous system	Carboniferous limestone	6·7	2·2
	Limestone shales	6·6	1·9
	Millstone grit	5·1	1·2
	Coal measures	5·8	1·6
Triass Permian	Magnesian limestone	2·5	0·7
Triass system	Bunter sandstone	2·2	0·8
	Keuper marls and sandstones	3·9	0·8
Recent	Glacial sand and gravel	2·8	0·7
	Upland surface supplies	2·8	0·8

NOTE.—All except upland surface waters are derived from underground sources.

TABLE XI.—SHOWING IODINE CONTENT OF DERBYSHIRE DRINKING WATERS.

Origin of Water	Iodine per 100 millions	Goitre Incidence per cent.
Derwent Valley Water Board. Surface supply ...	Nil	4·2
Chesterfield R.D.C. Northern scheme. Surface supply...	Nil	3·0
Chesterfield R.D.C. Southern scheme. Surface supply...	Nil	3·1
Glossop Borough. Surface supply	0·08	2·8
Bakewell U.D. Millstone Grit	5·8	3·3
Baslow. Millstone Grit	2·6	6·3
Belper U.D. Millstone Grit	1·1	4·2
Chesterfield Borough Millstone Grit and Surface supply ...	10·0	2·6
Clay Cross U.D. Millstone Grit	0·78	2·8
Melbourne and Long Eaton U.D. Millstone Grit ...	1·5	8·0
Alfreton U.D. Millstone Grit and Surface supply ...	0·89	4·8
Wirksworth U.D. Millstone Grit	4·6	8·1
Bonsall U.D. Carb. Limestone	0·45	3·2
Carsington. Carb. Limestone	0·13	35·9
Heanor and Ilkeston. Carb. Limestone	0·8	5·4
Ashbourne U.D. Bunter Sandstone	0·49	3·8
Etwall. Keuper Sandstones	1·5	7·9
Sudbury. Glacial Sandstone	0·69	1·6
Derby Corporation. Alluvium and Surface Supply ...	0·18	1·7

TABLE XII.—SHOWING IODINE CONTENT OF DERBYSHIRE SOILS.

Geological formation	Situation	Iodine per 10⁷
Volcanic	Bonsall Moor	4·1
	Hopton	64·0
	Via Gellia	4·7
	Grange Mill	4·3
Carboniferous Limestone	Crich	5·9
	Crich	14·9
	Via Gellia	40·0
	Via Gellia	241·0
	Longcliffe	118·0
	Longcliffe	14·6
	Taddington	4·0
	Ashwood Dale	123·6
	Ashwood Dale	136·0
	Tideswell	36·0
	Sheldon	9·0
	Kirk Dale	8·1
	Newton Grange	14·6
	Lathkill Dale	46·6
	Lathkill Dale	31·3
	Elton	11·3
	Middleton (Wirksworth)	97·6
	Winster	38·6
	Parwich	83·3
	Hartington	30·6
Limestone Shales	Ashopton	8·6
	Edale	4·6
	Chapel-en-le-Frith	34·6
	Hassop	8·0
	Calver	15·0
	Hathersage	7·9
Millstone Grit	Whatstandwell	3·0
	Brock Gate	4·7
	Brock Gate	22·4
	Coxbench	6·0
	Little Eaton	1·0
	Little Eaton	9·0
	Two Dales	7·0
	Two Dales	95·0
	Beeley	16·5
	Beeley	28·3
	Beeley	14·8
	Beeley	19·0
	Hayfield	1·0
	Grindleford	10·0
	Charlesworth	40·0
	Glossop	57·9
	Glossop	19·3
	Glossop	20·6
	Glossop	9·3
	Glossop	3·9
	Glossop	15·9
	Birchover	0·6
	Alport	11·3
Coal Measures	Heanor	12·6
	Heanor	15·3
	Heanor	10·0
	Heanor	13·3
	Heanor	53·0
	Heanor	34·3
	Horsley Woodhouse	14·0
	Smalley	15·0
	Shipley	36·0
	Heage	35·3
Alluvium	Hope	13·3
Glacial Sand.	Bugsworth	1·3

NOTE.—The average iodine content of soils examined was found to be:—

	Parts Iodine per 10⁷
Volcanic	20
Carboniferous Limestone	55
Limestone Shales	13
Millstone Grit	18
Coal Measures	24

FIG 12.—Map showing situations from which soil samples were taken.

TABLE XIII.—DERBYSHIRE ROYAL INFIRMARY. GOITRE CASES ADMITTED FROM 1894-1928.

In-Patients.

Place	Vesicular goitre	Adenoparenchymatous goitre	Exophthalmic goitre	Malignant goitre	Myxœdema	Cretins	Acute thyroiditis
Alfreton	5	3	1	—	1	—	—
Ashover	—	1	1	—	—	—	—
Ashbourne	3	3	—	—	—	—	—
Ashford	1	—	—	—	—	—	—
Ambergate	—	1	3	—	—	—	—
Breaston	—	2	—	—	—	—	—
Bakewell	—	1	—	—	—	—	—
Bradley	1	—	—	—	—	—	—
Belper	3	6	2	—	1	—	—
Brailsford	—	—	1	—	—	—	—
Bonsall	—	1	—	—	—	—	—
Buxton	2	—	—	—	—	—	—
Borrowash	—	—	1	—	—	—	—
Clay Cross	—	—	3	—	—	—	—
Codnor Park	—	1	—	—	—	—	—
Chesterfield	—	1	1	—	—	—	—
Chaddesden	—	2	1	—	—	—	—
Chellaston	—	1	—	—	—	—	—
Church Gresley ...	1	—	—	—	—	—	—
Derby	53	67	74	2	5	1	—
Dalbury Lees	—	—	1	—	—	—	—
Darley Dale	—	2	2	—	—	—	—
Doveridge	2	—	—	—	—	—	—
Draycott (Sudbury) ...	—	1	—	—	—	—	—
Duffield	—	1	—	—	—	—	—
Draycott	1	—	—	—	—	—	—
Denby	—	2	—	—	—	—	—
Eggington	—	1	—	—	—	—	—
Etwall	2	1	1	—	—	—	—
Findern...	1	—	1	—	—	—	—
Heanor	2	4	2	—	—	—	—
Holloway	1	—	1	—	—	—	1
Holbrook	1	—	1	—	—	—	—
Hemingtom	—	1	—	—	—	—	—
Horsley W'hse.	1	—	—	—	—	—	—
Hilton	—	1	1	—	—	—	—
Hulland Ward	—	1	1	—	—	—	—
Heage	1	1	1	1	—	—	—
High Peak Jcn.	—	1	—	—	—	—	—
Ilkeston...	1	2	—	—	—	—	—
Ingleby	—	—	—	—	—	1	—
Isley Walton	—	1	—	—	—	—	—
Idridgehay	2	—	—	—	—	—	—
Kirk Ireton	—	1	—	—	—	—	—
Kirk Langley	—	—	3	—	—	—	—
Kilbourne	4	—	1	—	—	—	—
Kniveton	—	1	—	—	—	—	—
Little Eaton	—	1	—	—	—	—	—
Long Eaton	3	1	1	—	—	—	—
Longford	—	—	—	—	1	—	—
Melbourne	—	2	2	—	—	—	—
Mercaston	—	—	1	—	—	—	—
Mickleover	3	1	—	—	—	—	—
Middleton by Wirksworth	—	1	—	—	—	—	—
Milford	—	1	1	—	—	—	—
Matlock...	1	—	1	—	—	—	—
Morley	—	—	—	—	1	—	—
New Tupton	—	—	1	—	—	—	—
Ockbrook	2	2	—	—	—	—	1
Pilsley (Chesterfield) ...	1	—	—	—	—	—	—
Parsley Hay	1	1	—	—	—	—	—
Parwich	—	1	1	—	—	—	—
Quarndon	—	—	1	—	—	—	—
Ripley	3	2	3	1	1	—	—
Riddings	—	3	2	—	1	—	—
Somercotes	—	1	2	—	—	—	—
Swanwick	4	—	1	—	—	—	—
Carried forward	106	129	121	4	11	2	2

TABLE XIII—(*continued*).

In-Patients.

Place	Vesicular goitre	Adenoparenchymatous goitre	Exophthalmic goitre	Malignant goitre	Myxœdema	Cretins	Acute thyroiditis
Brought forward	106	129	121	4	11	2	2
Stanley	2	—	—	—	—	—	—
Spondon	—	3	3	—	—	—	—
Sandiacre	—	—	3	—	—	—	—
Smalley	—	—	1	—	—	—	—
Stanton by Bridge ...	1	—	2	—	—	—	—
Shirland	1	—	—	—	—	—	—
Sutton-on-the-Hill ...	—	—	1	—	—	—	—
Thulston	1	—	1	—	—	—	—
Tissington	1	—	—	—	—	—	—
Tansley	—	—	1	—	—	—	—
Ticknall	—	—	1	—	—	—	—
Weston Underwood ...	—	1	—	—	—	—	—
S. Wingfield	—	2	—	—	—	—	—
Weston-on-Trent ...	2	3	—	—	—	—	—
Wirksworth	1	2	1	—	—	—	—
Wessington	—	1	—	—	—	—	—
West Hallam	1	—	—	—	—	—	—
Willington	—	—	1	—	—	—	—
Youlgreave	—	2	1	—	—	—	—
Total	116	143	137	4	11	2	2

TABLE XIV.—MANCHESTER ROYAL INFIRMARY.

DERBYSHIRE GOITRE CASES ADMITTED 1909-1914 AND 1920-1927.

Place	Disease	Age	Sex	Occupation
Ashford ...	Exophth. goitre ...	38	F.	House
Bugsworth ...	Adenoma ...	35	F.	Weaver
Bugsworth ...	Hyperthyroidism ...	40	F.	Weaver
Buxton ...	Parench. goitre ...	19	M.	Boot repairer
Buxton ...	Cyst adenoma ...	38	M.	Farm labourer
Buxton ...	Exophth. goitre ...	19	F.	
Buxton ...	Exophth. goitre ...	37	F.	House duties
Buxton ...	Malignant goitre ...	48	F.	House duties
Buxton ...	Exophth. goitre ...	52	F.	
Buxton ...	Exophth. goitre ...	27	F.	House duties
Fairfield ...	Parench. goitre ...	15	F.	
Fairfield ...	Malignant goitre ...	56	M.	Farmer
Glossop ...	Exophth. goitre ...	20	F.	Weaver
Glossop ...	Exophth. goitre ...	49	F.	House duties
Glossop ...	Adenoma ...	42	F.	Cotton weaver
Glossop ...	Toxic adenoma ...	41	M.	Insurance agent
Glossop ...	Adenoma ...	27	F.	
Glossop ...	Exophth. goitre ...	41	F.	Maker up
Glossop ...	Exophth. goitre ...	42	F.	House duties
Glossop ...	Adenoma ...	37	F.	Weaver
Glossop ...	Cystic goitre ...	18	M.	Metal worker
Glossop ...	Parench. goitre ...	29	F.	Paper sorter
Great Longstone ...	Exophth. goitre ...	19	F.	House duties
Hadfield ...	Exophth. goitre ...	49	F.	Weaver
Hayfield ...	Parench. goitre ...	32	M.	Labourer
Marple ...	Exophth. goitre ...	29	F.	Cardroom tenter
Marple ...	Cyst adenoma ...	51	M.	Insurance agent
Mellor ...	Adenoma ...	65	F.	House duties
New Mills ...	Exophth. goitre ...	17	F.	Saleswoman
New Mills ...	Exophth. goitre ...	41	F.	House duties
New Mills ...	Toxic adenoma ...	34	F.	House duties
New Mills ...	Adenoma ...	58	F.	House duties
Youlgreave ...	Exophth. goitre ...	31	F.	House duties

Total = 33. Exophth. goitre = 16
Parench. goitre = 4 (Vesicular)
Adenoma = 10 } Adenoparenchymatous goitre
Cystic goitre = 1 }
Malignant goitre = 2

TABLE XV.—SHOWING AGE AND SEX DISTRIBUTION OF GOITRE IN DERBYSHIRE SCHOOL-CHILDREN.

Age	Number examined	Degree of Goitre per cent. *	**	*** or over	** and *** or over	All goitres
	Girls.					
13	3,437	10·4	5·9	3·8	9·8	20·2
12	3,287	9·9	5·2	2·7	7·9	17·9
11	3,442	8·4	4·1	1·6	5·7	14·2
10	3,316	7·7	3·2	0·57	3·8	11·6
9	3,312	6·5	2·1	0·27	2·4	8·9
8	3,260	5·6	1·1	0·2	1·4	7·0
	20,074	8·1	3·6	1·5	5·2	13·3
	Boys.					
13	3,617	6·4	2·5	1·2	3·7	10·1
12	3,174	6·9	2·7	0·5	3·2	10·2
11	3,348	6·0	1·7	0·6	2·3	8·3
10	3,420	5·9	1·5	0·26	1·78	7·6
9	3,323	4·9	1·3	0·27	1·5	6·5
8	3,088	4·3	0·7	0·06	0·77	5·1
	19,970	5·7	1·7	0·5	2·2	8·0

Discussion.—Mr. C. A. JOLL said that Dr. Turton had made out a strong case against the iodine deficiency theory as the main causation factor of endemic goitre at least for Derbyshire. It could not be assumed, however, that what applied to a particular district in this country was true of endemic goitre throughout the world. Indeed the work of Hercus and Roberts in New Zealand, Eggenberger in Switzerland, Wagner-Jauregg in Austria, and Olesen in America, pointed so strongly to the ætiological importance of iodine-deficiency that much weightier rebutting evidence must be forthcoming to displace that theory in the areas referred to. Dr. Scott-Williamson had stated that in endemic goitre the total iodine content of the thyroid was increased, but this was by no means invariably the case, as de Quervain's students had clearly demonstrated.

He (Mr. Joll), however, joined issue with Dr. Turton with respect to the pathology of endemic goitre. It was unnecessary to speak of hypertrophic goitre as a form of endemic thyroid enlargement, since in all cases such as Dr. Turton had shown on the screen and identified with the term "hypertrophic goitre," in his (Mr. Joll's) opinion the structure of the gland was that of a colloid goitre; this he had verified from material obtained in goitrous districts of Gloucestershire, Hereford, Radnor, and Montgomery. He would also like to know on what ground "lymphadenoid goitre" had been included as a type of endemic goitre when in fact it occurred as a purely sporadic condition, chiefly in middle-aged females.

Finally, whatever theory might be advanced to explain endemic goitre there still remained the difficulty that a large percentage of the population in endemic areas, in spite of a water-supply and diet in common, did not in fact become goitrous, and on the other hand goitres strictly comparable in pathological structure to those found in the endemic areas were to be seen sporadically among people whose condition as to diet, standard of general and personal hygiene were, so far as could be known, quite perfect.

He hoped that Dr. Turton's admirable example would be followed by doctors in all other goitrous districts in Great Britain.

Dr. H. GARDINER-HILL said that Dr. Turton had laid great stress on what might perhaps be termed the extrinsic factors in endemic goitre, pollution of water and lime-stone water supplies. If these factors played such an important role, why was it that only 5% of adolescent children living in those areas developed goitre, and what were the factors in the other 95% which prevented them developing simple goitre? He would like to ask Dr. Turton what part he considered intrinsic factors played in the genesis of endemic goitre. He had in mind particularly heredity and the sex events in the female. In his experience, both these factors played an important part in sporadic goitre. He would like to mention the history of a family which illustrated this point. The grandmother in this family was a goitre-bearer, living in an endemic area; the goitre in her case had developed when she was at the age of puberty. She gave birth to eight children, seven daughters and one son, her goitre becoming hypertrophied during the third and subsequent pregnancies. All her children spent their childhood and adolescence in the same endemic area, though only the sixth daughter became

affected. This girl developed a simple goitre at puberty. The five elder daughters married, and moved to immune territory. All subsequently developed goitre, but at different periods of their lives: the first during pregnancy, the second at the climacteric, the third at the climacteric, the fourth during pregnancy, and the fifth during pregnancy. In the third generation two children of the sixth daughter developed simple goitre at puberty. The other members of this generation were unaffected. This pedigree is a good illustration of an hereditary influence in endemic goitre, for all but one of the affected members of the second generation, and both the affected members of the third, developed the condition outside the endemic area. It also appeared to illustrate the point that the sex events played a part in the genesis of endemic goitre, though what is inherited was not strictly speaking goitre, but some abnormality which might readily manifest itself as goitre if conditions were suitable. This pedigree was also interesting because it illustrated another point, that hereditary predisposition in such families might disappear after emigration from endemic territory.

Dr. Turton had laid great stress on the harm which might be done by giving iodine to patients with endemic goitre of the hypertrophic and adeno-parenchymatous types, but he (Dr. Gardiner-Hill) had seen many sporadic cases treated with iodine, and he did not remember a single instance in which iodine could be held responsible for the development of toxic symptoms. He had frequently seen such cases develop a mild thyrotoxæmia, but nearly always it accompanied an infection; though the patients were taking iodine at the time, everything pointed to the infection rather than the iodine as the cause, as the toxic symptoms abated when the infection passed off. The possibility of an infection was worth considering in endemic goitres, when a temporary thyrotoxæmia developed during treatment with iodine. In over a hundred cases of secondary Graves's disease which he had recently reviewed, there was not a single incidence in which the onset of secondary thyrotoxæmia could be attributed to iodine medication. If iodine was harmful to hypertrophic and adenoparenchymatous goitres, one would have surely expected examples in a series as large as this.

Dr. G. CLARK TROTTER said that the previous Medical Officer of Health for the County of Derbyshire had arranged for the distribution of iodized chocolate tablets or iodized salt to school children, based on the American work at that time on the lack of iodine in vegetables, and the analysis of the subsoil water. The Medical Officer of Health who succeeded him took a contrary view and stated that the American work was fallacious.

It had been said that iodine was harmful, but undoubtedly some cases of enlargement of the thyroid responded and the goitre disappeared under iodine treatment.

JOINT DISCUSSION No. 7.

Section of Comparative Medicine and Section of Therapeutics and Pharmacology.

Chairman—W. HORNER ANDREWS, M.R.C.V.S. (President of the Section of Comparative Medicine).

[*February* 22, 1933.]

DISCUSSION ON PLANT POISONING IN MAN AND ANIMALS.

The Chairman: I propose to deal with a few points in connection with plant poisoning in animals that appear to be of general interest. There is first the question of the actual importance of plant poisoning in the domesticated herbivora, as poisoning of the other domesticated animals by plants can occur only very occasionally. Plant poisoning in domesticated herbivora plays a much larger part in some overseas countries where animals more generally graze on pastures which are little, if at all, altered from their natural state. In this country many animals spend only a limited part of their existence in grazing, and even those which graze more extensively or continuously can hardly be regarded as grazing on natural pasture. In most instances the pasture has been modified by human interference; there has generally been a deliberate selection of particular plants in the pasture, and we should expect to find the recognized poisonous plants greatly reduced in number, although in many cases it may be difficult to get rid of them altogether. We still find poisonous plants, particularly in hedgerows, and the losses from this cause among our domesticated animals are far from negligible. Further, we may well doubt whether all plant poisoning is recognized as such; probably there are many cases of poisoning that are attributed to other causes.

It is usual in connection with animals to suspect plant poisoning when certain particular types of symptoms are seen. Everyone is familiar with many plants which act more particularly as irritants, causing well-known and easily recognized symptoms. There are also well-known plants which cause well-defined nervous symptoms and, in general, one may say that we recognize the majority of cases of poisoning due to plants which act as irritants, narcotics, narcoto-irritants, etc. It is important to note that in most of these recognized forms of plant poisoning, the symptoms are of certain well-known types and they appear comparatively rapidly after the consumption of the plant. Many plants have been known from the earliest times to be poisonous because it was always easy to associate the effects with the cause. Matters are very different, however, when the effects of the consumption of a poisonous plant are of an unusual nature, and particularly when the effects may appear only after a considerable interval of time. In such cases there may be no suspicion whatever that a poisonous plant has been eaten, and I think it at least possible that we have this type of poisoning in Britain on a larger scale than has yet been recognized.

Our present knowledge of plant poisons is most unsatisfactory. In the first place, it seems probable that some plants are definitely poisonous to animals without their injurious effects being recognized. On the other hand, of the very many plants believed to be poisonous, it is probable that many are hardly poisonous at all, or at least only feebly so. Many plants are mentioned in books on the subject as a result

of some incident in which suspicion was directed towards the particular plant as a cause of an illness, only because no other cause could be found. In many instances the evidence is extremely weak, and a considerable number of these supposed poisonous plants have never been proved by any definite scientific test to be poisonous to animals under any conditions at all. It should further be recognized that a plant may contain active principles of a poisonous nature without in any way threatening the health of herbivorous animals, as such plants, in a number of instances, are so unpalatable that animals will not consume them in any significant amount, even under the stress of severe hunger.

In passing, I would say that plants have often been examined by chemical methods, and chemical substances extracted from them have been examined as to to their pharmacological action and toxicity, without any proof having been furnished that the plants under natural conditions were really poisonous at all. Information of that kind might prove valuable in connection with pharmacology and therapeutics, but from the practical point of view it has no direct bearing on problems of poisoning, unless it can be shown that animals may be persuaded to eat sufficient of the material to cause injurious effects. It appears to be greatly preferable that the order of the investigation should be reversed, and that the first step should be to show that the plant may be eaten in significant quantity.

Another very interesting aspect is involved in the inquiry as to why animals eat poisonous plants. I believe that in the majority of instances great hunger is the explanation, and that poisonous plants are eaten on account of a shortage of other food-stuffs. It appears that the majority of the plants known to be poisonous are unattractive to animals or unpalatable, and they are eaten only with some reluctance. It is of interest to note that cattle and other domesticated animals often appear to eat certain plant materials more readily when they have been cut than when they are growing naturally. A number of plants seem to be particularly dangerous when cut and thrown down. In general, animals exercise discrimination in their choice of plants in a mixed pasture, and in a country where the natural vegetation is comparatively little disturbed, where it varies greatly in different areas, and where animals are liable to be moved from one region to another, it is interesting to note how certain poisonous plants are avoided by cattle regularly resident in the district, but may be eaten by new arrivals. Very often these new arrivals are particularly hungry, and their ordinary habits may have been disturbed by the strange and perhaps terrifying conditions of travel, but, apart from that, it is curious that cattle seem to reject most of the poisonous plants in the particular area in which they were bred, although some of those plants may prove dangerous to animals bred elsewhere. This discrimination may be upset by excessive hunger, and probably by other factors also. I think it probable that in some cases specific deficiencies of the diet may disturb the normal discrimination, and that such deficiencies may possibly be of considerable importance in bringing about plant poisoning.

I have never seen any proof that animals may develop a habit or craving for a particular species of plant, but I gather that this may be so in connection with the loco weeds of North America. On one occasion I believed that I had observed the formation of a habit. I was experimenting with a *Matricaria* which caused the death of large numbers of cattle in Natal. The plant was eaten reluctantly by normal cattle, and only when they were very hungry. I noted that one bovine animal, after it had been forced to consume the matricaria for more than a week, would eat additional quantities very greedily. Apart from this unusual behaviour, the animal acted in a normal way and appeared to be quite healthy. It ate the matricaria much more readily than other and equally hungry animals, and quite as willingly as it would eat fresh grass. It seemed at first that there was some evidence of the development of a craving for this plant, but further tests showed that

the animal had lost the power to discriminate between different plants. It would not only eat the matricaria, which was moderately unpalatable to the normal animal, but it would also eat other and considerably less palatable plants that normal cattle would not touch even when practically starving.

The question of specific susceptibility is of considerable interest in connection with the poisoning of animals by plants. We are well aware that various active principles will show qualitatively or quantitatively different pharmacological effects in different species of animals, but with some poisonous plants we appear to find something more than that. I will illustrate my meaning by referring again to *Matricaria nigellæ-folia*. When the plant is administered repeatedly in small amount, a total quantity of only 21 lb. may cause the death of a young ox, but I failed to induce with it any specific effects in any of the domestic animals other than cattle. The plant was eaten (under compulsion) by horses, sheep, goats, pigs, rabbits and guinea-pigs, but in all cases without any definite effects, in spite of the fact that, as compared with the cattle, all these animals received considerably larger amounts in relation to the body-weight. For example, pigs received as much as 48 lb. and horses more than 200 lb. The position appears to be similar in connection with bracken. It is quite easy with bracken to set up fatal poisoning in cattle, but relatively much larger amounts appear to have no ill-effect at all on sheep, and I believe that it is perfectly safe to graze sheep on areas largely covered by bracken.

The concentration of the active principles in poisonous plants may vary very considerably, and may be greatly affected by such factors as soil and climate. The concentration is also known to vary in different parts of the plant and at different stages of growth. In some instances, e.g., the "gift blaar" of South Africa the young leaf by weight may be quite twenty times as poisonous as an older and larger leaf. Sometimes we encounter variations that cannot be connected with such obvious factors as the stage of the plant's growth, and they may be extremely difficult to explain. As examples I might quote two diseases of sheep that have been investigated by Theiler in South Africa. The first of these is the so-called "gousiekte," which was given that name of "quick sickness" on account of its extremely rapid development, many of the animals dying within a few minutes, or even seconds, of the first appearance of noticeable symptoms. This disease has been shown to be caused by the ingestion of *Vangueria pygmæa*, but the plant will not always cause these specific effects, and in fact, in some experiments it has appeared to be non-toxic. Another example is the so-called "geeldikkop" of sheep, which is characterized by jaundice and by the occurrence in the region of the head of œdematous swellings, with subsequent superficial necrosis. It was shown by Theiler and his co-workers that this disease may be set up by feeding the plant *Tribulus terrestris*, and that the effects may be given by the plant gathered in the pre-flowering, flowering, or late fruiting stage. Very often, however, quantities of this plant may be collected and given to sheep without causing any noticeable effects at all. We do not know the factors involved, but there is no doubt that at one time the plant will cause these specific effects, and at another time it may cause no harm at all. In fact, in certain areas, and at particular seasons, it is regarded as a useful fodder plant. The incidence of the disease in the field agrees with the facts revealed by experiment. Sheep may be grazing on pasture containing a large amount of the *Tribulus* and for a considerable time no geeldikkop may be seen; the disease may appear suddenly and cause considerable loss and it may then disappear, although the animals are still grazing over the same area. There is some evidence that the appearance or disappearance of the poisonous constituents is related to the occurrence of particular climatic conditions but the evidence is not yet clear.

I wish to draw particular attention to the existence of a group of plant intoxications which develop only after a latent period, during which the animals may appear to be perfectly healthy. On many occasions symptoms of poisoning

appear only some considerable time after animals have been grazing on pasture in which poisonous plants are present. In many instances that fact may readily be explained by assuming that the animals have not eaten any of the poisonous material until they have been forced to do so by the increasing scarcity of more palatable food. That explanation would be perfectly correct in many instances, but in connection with poisoning by some plants it has been found that symptoms never appear until animals have been feeding for weeks on the plant in question. In actual experiments animals have been compelled to eat considerable quantities of some of these plants, and periods of many weeks have always elapsed before any effects were seen. Further, if the feeding on these particular plants is discontinued, there may still be a latent period of considerable length before the appearance of any symptoms of illness. In the case of poisoning by *Matricaria nigellæ-folia* the latent period may be as long as six weeks. In the poisoning of horses by *Crotalaria dura* the period may be as long as eighty days, and with *Senecio latifolius*, symptoms have appeared ninety-six days after the last occasion on which the plant was eaten. Where the period of latency is as long as in these instances, the animal owner is hardly likely to associate the plant with the effects caused by it. Some of these plant intoxications of very slow development are known to be of great importance in some countries, such as South Africa. They are not known to be of any great importance in this country, but I do not think that we can exclude at least the possibility that there is more poisoning of that kind than has been recognized. It appears that *Senecio* poisoning sometimes occurs in very dry summers, and no doubt the development of the condition here would be very similar to that observed elsewhere. The facts in connection with bracken poisoning of cattle have not yet been fully established, but it seems probable that a latent period occurs in its development. It would be of interest to know the length of the latent periods that might occur in connection with chronic poisoning by some of the better-known poisons of known constitution. It is recognized that delayed action may be observed after the administration of even a single large dose of certain poisons, the original injury leading subsequently to progressive changes. In the plant intoxications to which I have referred, it would be interesting to study the course of events in more detail, and to endeavour to distinguish between the parts respectively played by accumulation of poisonous substance and by the summation of repeated injuries.

Clinically these slow plant intoxications naturally differ considerably from the more acute forms of poisoning with which everyone is familiar. In a number of instances the most conspicuous lesion is a chronic hepatitis or cirrhosis of the liver. In such cases the animals before death frequently show symptoms which one would associate more particularly with an affection of the central nervous system. In some instances the symptoms and lesions are not of a type that one would associate ordinarily with plant poisoning; for example, in *Crotalaria* poisoning in horses, the most conspicuous lesions are emphysema of the lungs and a chronic pneumonia. It has been suggested that some of the more unusual effects are directly caused by bacteria, the injuries inflicted by the plant poison having opened the path to secondary bacterial invaders, but I do not think that there is any satisfactory proof of that hypothesis.

In conclusion, I would remark that interesting clinical pictures may be seen in connection with some of these forms of plant poisoning, especially when the plant contains more than one active principle. An instance of this kind is afforded by *Adenia* or *Modecca digitata*, the properties of which were investigated by Dr. H. H. Green and myself in South Africa. The material was found to contain both a cyanogenetic glucoside and a toxic protein. The cyanogenetic glucoside naturally acted quickly, and after oral administration of the material; the toxic protein was slow in action. When the material was administered to such an animal as a sheep, the symptoms of poisoning by hydrocyanic acid would develop in about twenty

minutes. Unless the quantity was very considerable, the animal would probably recover rapidly from this, and it would then appear to be quite normal for a couple of days before beginning to develop gastro-enteritis and other effects which were caused by the toxic protein, and which were almost invariably fatal.

Sir William Willcox: As the Chairman has said, there is very little known about plant poisoning: we know almost nothing about it in this country, and there are not many plants in our land which are poisonous. But if one goes to tropical countries one meets with enormous numbers of plants which have the reputation of being exceedingly poisonous but of which there is no exact knowledge in the books.

Plant poisoning is very interesting because it is so closely related not only to toxicology, but also to pharmacology and therapeutics. We know that many of the active principles of poisonous plants are alkaloids or glucosides; some of these are used largely in medicine, and while in therapeutic doses they are beneficial, in large doses they may be very toxic.

Plant poisoning in man is not common in England. Occasionally it occurs in children or uneducated people: they may sometimes eat belladonna ("deadly nightshade") berries. Or a child may eat the berries of a yew—pink berries which are very sweet. If the seed is chewed it is very poisonous. Occasionally, too, cases of aconite poisoning occur, owing to the eating of aconite root in mistake for horse radish. Woody nightshade contains the alkaloid solanine; the berries are sometimes eaten by children, and produce symptoms similar to those of belladonna poisoning: woody nightshade is often mistaken for the true belladonna or deadly nightshade.

Criminal poisoning from poisonous plants, as I know from reports sent to me from India, Malay, Ceylon, and so on, is common.

The relative toxicity of various poisons eaten by different species of animals is a field in which very little work has been done, but it is one of great interest. One knows that some poisons which are deadly to man, such as the alkaloids of the solanaceæ group, are harmless to many herbivora: rabbits and hares can eat belladonna with impunity, whereas human beings and carnivora would be poisoned very quickly by them. I believe that parrots are insensitive to many poisons which are very deadly to other creatures. Hedgehogs, too, can take large quantities of certain alkaloidal poisons which would be fatal to human beings.

To mention some of the plants which are poisonous to man and to some animals, there is the belladonna group, which contains the alkaloids atropine, hyoscine, hyoscyamine, and includes the deadly nightshade, stramonium, hyoscyamus, etc., which contains a similar group of alkaloids. Hyoscine and the other mydriatic alkaloids of this group are very poisonous to man and the carnivora, whereas the herbivora are comparatively immune.

Plant poisons do not quite adhere to the botanical groups; not all the solanaceæ contain mydriatic alkaloids. Tobacco belongs to the solanaceæ group, and has for its active principle, nicotine, a liquid alkaloid, which is a very deadly poison, and may cause definite symptoms of poisoning.

Tobacco preparations are used for horticultural purposes, and recently someone was poisoned through taking by mistake nicotine intended to be used in this way.

The Chairman has mentioned the long latent period sometimes observed in plant poisoning. We have examples of that in human beings. The tobacco which we smoke is usually matured and carefully prepared; it is not just the raw leaf. Smoking tobacco which has not been properly matured may bring on that curious disease thrombo-arteritis obliterans. I have known such cases.

Another example of delayed poisoning is afforded by ergot. Animals fed on rye which is contaminated with the ergot mycelium may, after some time, develop gangrene, owing to the action of the ergot on the blood-vessels.

Aconite is a common plant and a deadly poison. It may cause poisoning accidentally from the eating of the root, or it may be used for criminal purposes. This plant contains the most poisonous alkaloid known, aconitine, and it has been used in several cases with criminal intent, as in the famous Lamson case. Aconite is a deadly cardiac and nerve poison, and produces local anæsthesia of mucous membrane. The test for aconite is to extract the alkaloid and put the poison on the lips, when you find it produces a numbness. There are not any specific chemical tests, but in the mouse as little as the one-thousandth part of a grain will produce the characteristic symptoms, i.e.—paralysis of the hind legs, convulsions and hiccough—and the animal dies in about three quarters of an hour.

Though the ox and the horse are less susceptible to strychnine than man is, and can take relatively large quantities of it without apparent harm, nux vomica, the strychnos plant, is very poisonous to practically all animals. Strychnine is very poisonous to frogs, and the physiological test of strychnine on the frog is even more delicate than the chemical test. You can cause convulsions in the frog with a dose of the one-hundredth part of a milligram, or even less; this will put the frog into such a state that the slightest tap on the table on which it is lying will throw it into convulsions.

The hemlock group of plants contain the conine alkaloid. In a recent number of the *Veterinary Journal* there appears a paper on poisoning of pigs by water-hemlock. That plant contains an active toxin which is very poisonous to animals, and, no doubt, is equally poisonous to man. Hemlock is one of the oldest poisons known.

There is also an interesting group of fish poisons. *Cocculus indicus* contains picro-toxin, which is a powerful poison to fish. This is a substance used in therapeutics to control the night-sweats of phthisis; as it is highly toxic, only very small doses are used. In Malay there is a plant, the tuba, which is also used a good deal for poisoning fish; fish become intoxicated with it, and then they can easily be caught with the net.

In conclusion I will mention one thing which is rather contrary to the general trend of what I have been saying. Broom contains the active principle sparteine, which is used in France as a cardiac tonic and diuretic, but is not much used as a medicine in this country. I remember Dr. Monod, whose death last summer we so much regret, saying in his Hunterian Lecture that in the mountainous districts of France and Switzerland the sheep, when they come down the mountains, ate the broom tops, which protected them from the effects of the bites of vipers. Whether or not that is correct I do not know, but it is an interesting possibility that plants may not only be poisonous, but may also have the reverse effect, i.e., protecting animals from the bad results of snake bites.

Dr. P. Haas: A comprehensive discussion of plant poisoning should include some reference to the plant, as the source of the poisonous materials concerned. As has already been pointed out in the case of belladonna, a substance which is highly toxic to human beings may be harmless to animals; thus fowls and ducks are said to be much less sensitive to opium than human beings are, and it is said that the rhinoceros bird, *Bucoceros rhinoceros*, feeds on nux vomica seeds. Though unable to vouch for this, I have certainly come across strychnos seeds in the droppings of a wild cat; these seeds formed part of a collection of the fæces of tropical wild animals made by a botanist in the Government Forestry Service in Africa, interested in seed dispersal. The seeds in question were shown by chemical tests to contain strychnine, but there was unfortunately no evidence regarding their effects upon the animal, or as to whether the animal was in the habit of consuming such seeds. In this connection it is perhaps worthy of note that Saponins are extremely toxic to fish, whereas they are more or less harmless to most animals—including man—unless taken in considerable quantities.

The very marked differences in the metabolism of individual plants renders it extremely difficult to make any broad generalizations regarding the toxicity or otherwise of plants as a whole. It is true that certain families such as Papaveraceæ, Solanaceæ, Ranunculeæ or Leguminosæ are known to include a number of alkaloid-bearing plants such as the poppy, belladonna, henbane, aconite, laburnum, &c., while other families such as Rosaceæ or Labiatæ, are equally characterized by an absence of alkaloid-bearing members. Very striking differences may, however, be noted in the alkaloidal content of closely allied members of the same family, as in the case of the Oriental poppy—*Papaver somniferum*, which contains some twenty-five alkaloids—mostly toxic—while the closely related common red poppy—*Papaver rhoeas*, contains only one alkaloid, rhoeadin, which is practically innocuous. That climatic conditions may have a considerable effect upon the composition of one and the same plant is well shown by the common hemp plant, *Cannabis sativa*, which, when grown in India, contains the active principle which is characteristic of so-called Indian hemp, or hashish, while the same plant grown in Europe contains at most only traces of this principle. Some plants again, such as the wild bitter almond or the Burmah bean—*Phaseolus lunatus*—lose much of their poisonous character on cultivation, so that a plant which is toxic when grown in one part of the world may be innocuous when grown elsewhere.

Attempts to explain the significance of poisonous substances to the plants producing them also encounter difficulties. Assuming alkaloids to be products of protein metabolism, they might be expected to be concentrated in organs such as seeds, in which there is considerable metabolic activity—a theory which would appear to be borne out by the seeds of nux vomica, belladonna or taxus, but in the case of the poppy the seeds are quite free from alkaloids, although the latex, obtained from the seed capsule, is charged with the entire group of alkaloids which go to form opium. In some cases a plant such as *Taxus* may be toxic in its mature stage, while the young shoots are harmless; on the other hand *Lotus arabicus* is poisonous in the seedling stage, but when mature forms an excellent fodder crop.

From the few examples quoted it is obvious that in the absence of any very characteristic symptoms it is very difficult to draw conclusions as to the cause of death from the detection of plant remains in the stomach of a poisoned animal; even though the remains may be portions of a plant known to contain poisonous substances they may not be the organs in which the poisons are stored, or they may have been consumed from a plant at a period in its growth in which it is innocuous; accordingly the only equivocal proof rests upon the isolation of the toxic principle and the establishing of its occurrence in quantity sufficient to cause death; where the toxic principle is not as yet susceptible of detection or isolation such proof cannot of course be furnished. Only with increased knowledge of the pharmacology of the lesser studied poisonous plants is the difficulty of deciding upon the cause of death likely to be diminished, since, as will be seen from the above remarks, no general principles regarding the toxic nature of plants can be established.

Dr. J. A. Nicholson: In the natural order Ranunculaceæ are some of the most poisonous of British plants, e.g., *Aconitum napellus*, *Hellebore fœtidus*, *Hellebore viridis* and *Delphinium ajacis*. It is not intended, however, to discuss these here, but to refer to members of the order which are commonly known as buttercups. Esser (1910) considers these plants to be toxic to men, and Cornevin (1887) records that they have been used in human medicine as external irritants; decoctions of the plants have also been given internally, but for what purpose is not apparent. There are numerous records of alleged buttercup poisoning in animals. In some case the circumstantial evidence against these plants is very incriminating, and undoubtedly in the fresh state they may be injurious to livestock. On the other hand, it is very doubtful whether the buttercup *per se* is responsible for causing death. Up to the

present, no systematic examination of their toxicity has been undertaken, but it was thought to be of sufficient importance to inquire further into their poisonous nature, since certain buttercups are so common in our fields and meadows, and since they have been so frequently accused of causing ill-heath or death in livestock.

In connection with plant poisoning, many factors concerning both plant and animal, have to be considered, so that any investigation of this nature is liable to be prolonged. The work described here was begun at the Department of Animal Pathology, Cambridge, last autumn, and, although the experiments are only in the early stages, it is hoped that the results so far obtained may throw some light on the toxicity of buttercups.

Preliminary feeding experiments were carried out with four species of Ranunculus; *R. acris*, *R. bulbosus*, *R. repens* and *R. ficaria*. These were collected locally by my colleague, Mr. C. W. B. Wright, and fed to rabbits, guinea-pigs and sheep. At the time of collection the plants were in the flowering stage and seed formation had not begun. Rabbits and guinea-pigs were given a diet consisting exclusively of the buttercup plant but their health was apparently undisturbed and the same was true of the other animals used for experiment. Thus, one of the sheep ate 47 lb. of *R. ficaria* in eight days without any ill-effects during the feeding or during the six months following; in the smaller animals the only immediate effect was slight diarrhœa, and no delayed action was evident.

In view of these results, the juice was expressed from *R. acris* and *R. repens* and given to several rabbits by means of a stomach tube. Under these conditions the juice of *R. repens* appeared to have little action. One rabbit received 991 c.c. in thirty-one days, the initial dose being one c.c., with daily increases until during the last fortnight the animal was receiving 50 c.c. daily. The only noticeable effects were slight diarrhœa—which developed after the first fortnight—and loss of weight. With the juice of *R. acris*, however, the effects were more obvious. One rabbit, which had been given 40 c.c. within three days, began to refuse its normal food, and emaciation was progressive, with diarrhœa and excessive thirst, in spite of the fact that a little green food was still being taken. About the seventh day there was transient hyper-excitability, and muscular weakness developed, the animal being unable to stand without assistance. On the eleventh day, the feeding of the juice was discontinued after the animal had received 208 c.c. On the twelfth and thirteenth days the animal showed signs of improvement and ate a little green food, but death took place on the fifteenth day. On post-mortem examination there was gastro-enteritis, but the liver, heart and lungs appeared normal, both to the naked eye and on microscopic examination.

The symptoms shown by this animal and others which received the same treatment, did not indicate that there was any highly toxic substance present in the juice of these plants, but since the chemical nature of the substances present in buttercups had not been determined, my colleague, Mr. G. D. Shearer, undertook a chemical investigation of as many species as could be conveniently collected.

On steam distillation an acrid, pungent-smelling distillate comes over, from which a yellow oil is obtained on saturation with common salt and extraction with benzene, chloroform or ether. This substance which is the proto-anemonin of Asahina (1922) is present in a large number of Ranunculaceæ, and we have been able to extract it from eleven species. Unfortunately it was impossible to extract this product in every case immediately after distillation, and, as by polymerization crystals of a further substance, viz., anemonin are deposited, a greatly reduced yield of proto-anemonin has been obtained. In many cases also, the anemonin changed, probably through further polymerization, to white amorphous flakes which were insoluble in all solvents. This was particularly so with the distillates obtained from *R. bulbosus* and *R. sardus*, whilst the crystals deposited from *R. arvensis* did not change to nearly the same extent.

Asahina (1922) in Japan made a comprehensive study of anemonin, isolated from *R. japonica* and *R. sceleratus*. From 3,800 kg. of *R. japonica*, however, he obtained only 800 g. of crude anemonin, a yield of 0·02%, whereas we have obtained from *R. bulbosus*, for instance, a yield of 0·25% anemonin. *R. sceleratus*, which is said to be one of the most toxic of the buttercups, gave a very small yield of proto-anemonin, a fact which may have been due to the plant having been collected rather late in the season and to its not being available in any quantity.

Anemonin is a white crystalline solid, sparingly soluble in most solvents in the cold. According to Asahina (1922) it melts at 158° C., but the melting-point of our product, after purification, is 143° C. An analysis by combustion gave the same composition as Asahina's product, and a number of derivatives have been prepared, which point to the two substances being identical. Anemonin has none of the acrid, irritant properties of proto-anemonin, nor is it volatile in steam, although the steam from a hot-water solution does possess an irritant action on the eyes and nasal mucous membrane. Presumably in this case the anemonin is again broken down into proto-anemonin.

According to Czapek (1921), anemonin is the toxic principle of Ranunculaceæ, and attention was therefore first paid to the physiological action of this substance. The minimal lethal dose is 0·160 g. per kg. body-weight for mice when injected intravenously, and 0·280 g. per kg. body-weight for frogs. In rabbits intravenous injections of watery solutions produce no visible effects, even with doses as large as 0·150 g. Intraperitoneally in rabbits, the m.l.d. of anemonin appears to be about 0·150 g. per kg. body wt. In these cases, death does not occur until from twelve to twenty-four hours after the injection, and is due to the arrest of respiration, the heart continuing to beat for some time after the respiratory movements have stopped. With mice there may be violent convulsions or the animal may only show increased excitability with death usually in a few minutes. With frogs, no convulsions occur, but there is a general paralysis; the hind limbs are extended, the respiratory movements become slow, and finally cease, the animal sinks to the ground, reflex movements are gradually lost and the animal dies without a struggle from six to twenty-four hours later.

Up to the present it has been impossible to determine the exact mode of action of anemonin in higher animals, because of its low solubility in any fluid which is not in itself highly toxic. Further, since anemonin is only toxic in large doses and is comparatively slow in action, physiological experiments, which are essentially "acute" in nature, become difficult. Small doses of from 10 to 20 mgm. intravenously in rabbits merely cause a fall of blood-pressure, which passes off in a few minutes. This fall still occurs when both the vagi have been divided, but may be prevented by previous atropinization. With these doses no appreciable slowing of the respiration rate can be observed, and the heart shortly regains its normal rate. When larger doses—up to 100 mgm.—are given, slowing of both the heart and the respiratory movements can be seen and the blood-pressure falls slightly, but the total effect is small and the fall of blood-pressure is masked by the excessive quantity of fluid which has to be given, since the solubility of anemonin in water is only 2 mgm. per c.c. However, the effects observed in mammals, together with the experiments on frogs, appear to indicate that death is primarily due to paralysis of the respiratory mechanism and depression of the higher centres.

From the practical point of view, the action of anemonin is of smaller importance than was at first thought, since it has been definitely established that anemonin as such does not occur in the plant, but is formed from proto-anemonin after distillation. The latter substance is highly irritant, attacking the mucous membranes of the eyes and nose when a sample is left exposed to the air, and blistering the skin even in very dilute solution, with the production of extremely painful and slow-healing vesicles. Incidentally the skin-irritant action of proto-anemonin may be prevented by

immediate application of a dilute solution of potassium permanganate. Apart from its irritant action, proto-anemonin, like anemonin, appears to be comparatively non-toxic. Thus 1 c.c. intravenously causes merely a transitory rise of blood-pressure, presumably owing to vasoconstriction; no further effects are observed and subsequent injections produce no other disturbance.

In conclusion, it is evident that the active principle of the common buttercup is probably proto-anemonin. This occurs in its highest concentration in the flowering stage of the plant, and is destroyed to a certain extent by heat or by drying. It also occurs in the young green seeds, but whether it is present in ripe seeds has not yet been determined. It is found in only small amounts in the young leaves. In cases of true buttercup poisoning, the symptoms are associated with gastro-enteritis, debility and perhaps nervous derangement, but the plants may have indirect effects by permitting the absorption of other toxic products from the bowel. Finally, it is suggested that treatment with dilute solutions of potassium permanganate may be of service in checking the diarrhœa which is associated with the ingestion of buttercups.

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Dr. J. T. Edwards said that, important as plant poisoning of livestock was as a factor in rural economy in Great Britain, it was in the large grazing tracts of tropical and subtropical countries that it loomed most conspicuously as a deterrent in the rearing of animals. In the United States, South Africa, and Australia, for example, the study of plant poisoning had become one of the most important departments of veterinary research. He (the speaker) proposed to deal with plant poisoning of cattle in India. In 1927 he had had occasion to collect information upon the incidence of plant poisoning in cattle in preparing at the request of Government a small handbook on the cattle diseases of the country for the use of cattle owners. In this work he had received valuable information from Dr. W. Burns, Joint Director of Agriculture, Bombay Residency. It was very apparent that the exact knowledge available on the subject was meagre and defective. The reasons for the importance which live-stock poisoning assumed in a country like India must reside in the climatic conditions, with, annually, a long period of hot dry weather when vegetative growth was completely suspended, followed by a period of heavy rainfall (the monsoon) when vegetation suddenly became luxuriant, the lack of fodder conservation as an agricultural practice to provide for the period of seasonal shortage, the neglect of any attention to pasture lands as they were known at home, and the large areas of relatively barren land in which poisonous plants abounded, and which lay close to the villages where cattle were kept. Besides, criminal poisoning of live-stock, as well as of human beings, as had been pointed out by Sir W. Willcox, was a widely spread, ingenious practice in the East; and it was suspected that this practice was even condoned by the authorities in charge of *pinjrapoles* (or asylums for decrepit cattle) to support the revenues of these institutions. The most conspicuous examples of cattle poisoning which had come to his (the speaker's) notice in India were the following:—

(1) *Sorghum* (*jowar*) *poisoning*. *Jowar* (*Andropogon sorghum*) a crop largely cultivated in Northern India, was usually sown in the hot season, just before the break of the monsoon (late June). The stalks were cut while the plant was green, before the ears were formed, for cattle fodder. According to Taylor and Ghosh (1916) and Ghosh (1919), of the Pusa Institute, it had been found that plants which were very young, or stunted in growth, were dangerous, owing to the presence

of a glucoside (*dhurrin*) which, on fermentation, liberated prussic acid. Five grains of prussic acid given as a single dose was said to be fatal to an average beast, which could readily consume 60 lb. of *jowar* in a day; this quantity of the plant was found in Bihar to yield 30 gr. of prussic acid, i.e., six times the fatal dose for a beast. The hydrocyanogen content rapidly diminished with maturation of the plants, and in a normal year they ceased to be dangerous when they had grown for two months. In years when the monsoon was delayed, however, or partly failed, the poorly grown plants retained or accumulated poisonous properties, especially on dry lands, to become innocuous later when the rainfall was abundant. Poisonous properties were found chiefly in the stalks during the first three to four weeks of growth, and then rapidly decreased in the stalks, but persisted in the leaves, in gradually diminishing concentration, until maturity was reached. This might explain why goats were not very susceptible to poisoning with the young plants, because they only ate the leaves. Crops in adjoining plots of lands might yield very different amounts of poison. Storage of the green plants in a silo for three weeks or longer was said to be a good method of making them safe.

(2) *Criminal poisoning* by *Abrus precatorius*.—In some localities the *chamars*, a depressed class who plied hereditarily in the disposal of the carcasses of dead animals, regarded the hides of animals which died in their district as their special perquisite, and resorted to nefarious methods of ensuring a high death-rate, such as tempting animals with foods that were poisoned, especially with arsenic, or even spreading cattle plague and other infectious diseases. In some parts, as in the Central Provinces (Stirling, 1924) *chamars* resorted to criminal poisoning of cattle, most frequently by introducing into the rectum small needles or spikes (*suis*) impregnated with the crushed seed of *gumchi*, a leguminous jungle plant (*Abrus precatorius*). The powder contained the extremely toxic protein *abrin* (allied to the *ricin* of castor seeds), and the symptoms set up in the poisoned beast developed very rapidly and closely resembled those of blackleg. If this disease already prevailed among the cattle of a village, the *chamars* found it easy to increase the carcass supply without arousing suspicion.

(3) *Miscellaneous poisonous plants* (as communicated to the speaker by Dr. Burns):

(1) *Euphorbiaceæ*: (a) *Poinsettia pulcherrima*, a common ornamental plant of the Bombay Deccan, the milky juice of which had an unpleasant taste and might be poisonous. (b) *Jatropha curcas*, a wild plant, the seed of which was undoubtedly poisonous, and might be used for criminal poisoning of cattle.

(2) *Vinca pusilla*, a weed of pastures, reported to have caused drowsiness in cattle and buffaloes.

(3) *Acacia tomentosa*, a jungle tree, the pods of which were said to cause drowsiness and salivation (on two occasions analyses revealed 0·108% and 0·045% prussic acid respectively).

(4) *Datura fastuousa*, a weed, the seeds of which were used for criminal purposes in poisoning human beings and cattle.

(5) *Calotropis gigantea*; the juice was said to be introduced into the rectum to cause inflammation.

(6) *Nux vomica*, a jungle plant, the seeds of which (containing *strychnine*) were also said to be used for poisoning.

(7) *Ricinus communis*, the castor plant; a common, cultivated plant, the seeds of which contained the powerful toxic protein *ricin*, which was well known to cause severe fatal inflammation in the bowels of cattle and other animals after ingestion. The seeds might be found accidentally among other foods or in oil cakes, and accidental poisoning of animals had been reported in England from feeding on contaminated cake.

(8) *Nerium oleander*, the oleander plant, grown for ornament near water channels, undoubtedly poisonous, and said to have caused deaths among cattle.

(9) *Withania somnifera*, *Gloriosa superba*, and *Anamirta paniculata*, all said to have caused symptoms of poisoning; the root of the second was undoubtedly poisonous.

Reports of suspected poisoning received from Indian cattle-owners had always to be treated with the greatest scepticism. On several occasions Dr. Burns found that the plant material alleged to have caused poisoning was absolutely harmless. In such cases the owner or the suspected person alighted upon the first accessible thing to explain the cause of death, which might, in fact, have been caused by some poison administered or otherwise absorbed.

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Section of Orthopædics and Section of Surgery.

Chairman—G. R. GIRDLESTONE, F.R.C.S. (President of the Section of Orthopædics).

[*March* 7, 1933.]

DISCUSSION ON ACUTE SUPPURATIVE ARTHRITIS OF THE KNEE-JOINT.

Mr. P. H. Mitchiner: In looking up cases of suppurative arthritis of the knee-joint at St. Thomas's Hospital I was struck by the fact that there were not many there, and exploration of the various departments of the hospital resulted in the raising of only seventeen cases in the last two years. I did not get any statistics from the Venereal Diseases Department, in regard to cases of gonococcal arthritis.

The first thing which struck me in dealing with the causes of suppuration in the knee-joint was the fact that in none of these cases had it followed wounds of the knee-joint, and I had had the impression previously that a certain number of knee-joint wounds were followed by suppuration. During the last two years there have been six cases of penetrating wounds of the knee in St. Thomas's Hospital, and none of those six has gone on to suppuration. At the present time there is a case which came in four days ago, and that also is settling down quietly under our usual treatment—namely, excision of the wound, no washing-out of the joint at all, and the application of an extension. This case does not properly come under the heading of suppurative arthritis of the knee-joint, but it is of interest as showing that penetrating wounds of the knee are not usually, in civil practice, followed by suppuration of the joint. It is a different matter when we are dealing with compound fractures, such as were met with so often during the late war, when those involving the knee-joint were very fatal. During the war I was on the Salonica Front, where the cases, unfortunately, were nearly always several days old by the time I saw them, and I formed the opinion that prompt amputation was the proper treatment, because frequently where amputation was withheld it was found to be necessary shortly afterwards in order to save the patient's life. Even in the cases in which the limb was preserved, it was painful, and was only saved after a long convalescence, in an exhausted patient, the knee-joint, being at the best, only a 30% knee-joint. Therefore the prognosis in those cases, from the point of view of the local condition, I regard as very bad.

Of the seventeen cases of acute suppurative arthritis of the knee which I have had at St. Thomas's Hospital in two years, acute suppuration in the bone in the neighbourhood of the joint, with subsequent bursting into the joint, was responsible for six; and in all of these—as, in my experience, is always the case—staphylococci were recovered from both the blood and the joint. The lower end of the femur was the site in three out of the six cases, suppurative osteitis of the patella two cases, and of the upper end of the tibia one case. In all of them the joint was drained in the way that I always drain these joints, that is, by making an incision along the front of the biceps tendon. I open up the joint thoroughly and leave it to drain through that incision. It is an incision which I learned during the war—I think, from M. Péret—and it has proved very efficacious. I also apply extension to the limb. The bone lesion is also attacked and the pus evacuated. If I find pus under the periosteum in large quantities I do not open the medulla of the bone, but if there is any question as to the free exit of pus I trephine the bone and let the pus out; sequestrectomy has to be performed subsequently.

Patella cases are not so easily dealt with. One of these two cases was in a little

girl, and the other in a man aged 25. In one of the cases I am afraid the diagnosis was not established until three or four weeks after the patient entered the hospital, when the knee condition was clearing up, and X-ray examination showed osteo-periostitis in the patella. In one case a sequestrum was removed from the patella. In these cases draining and extension after operative treatment on the bone lesion resulted in a knee-joint which I should class as a 40% to 60% joint. At the end of three months I removed the extension and put the knee in plaster, allowing the patients up, and they remained in plaster another three or four months. They are then sent to the Massage department, and, if they are lucky, they get a 60% knee-joint.

We have had two cases due to acute epiphysitis in the lower end of the femur, both in young children. Neither of them has done well, and amputation had to be performed in both cases. In both the blood was positive for staphylococcus, which was also obtained from the joint. After amputation both patients improved and recovered.

One case was that of a boy who was acutely ill with what was obviously septicæmia. His knee-joint was distended with pus, and he died in delirium at the end of two days. The autopsy showed that the pericardium, peritoneum and pleura contained pus, and there was also purulent meningitis. Here, again, the causal organism was a staphylococcus, but no bone lesion was present, and we must regard it as a case of a pure septicæmic joint. No primary focus was found.

There have also been two cases of pyæmic joints, neither of them directly under my care, which I should call cases of subacute pyæmia. In one, the primary focus was an old suppurative osteitis, and in the other a carbuncle which had been present three months. Other abscesses also were present, and the signs in the knee-joint were not very marked, and both cases settled down under aspiration combined with the application of an extension. Subsequently they were put into plaster. One of them got a 60% mobile joint, the other a 90% joint. I had a conversation on the subject with Dr. Box—who is physician at the London Fever Hospital—and he said that pyæmic joints occur in from 6% to 10% of cases of scarlet fever, and that the knee was the favourite joint to be affected.

In the two years there had been only four or five cases of typhoid, and in one of them there was suppuration of the knee-joint, but I could not ascertain reliably what the state of the knee-joint had been, nor could I trace the patient.

There have been three cases of gonococcal suppuration of the knee, two of which settled down under extension and local treatment of the disease and the use of a vaccine. In one, in which aspiration had been carried out, extensive suppuration took place around the joint, leading to ankylosis.

There was one tragic case. A patient had been admitted because of an old accident—a fracture in the vicinity of the knee. There had been, at intervals, considerable effusion in the knee-joint for three or four years. The knee was aspirated by an enthusiastic house officer, who broke the needle in the joint. Suppuration followed, and the leg had to be amputated. It was an accidental case. in which you may say, if you like, that the suppuration was the result of a penetrating wound of the joint, but it was not in a normal knee-joint, as there was infected tissue round the old compound fracture. I think that, in this case, if an extension had been applied, or the limb had been in plaster, suppuration would not have occurred.

There were a few cases in which no cause was given for the suppuration, cases which I have not seen. One of them went steadily downhill, in spite of treatment first by aspiration, secondly by opening the joint and washing it out. But I cannot find any record of extension having been applied. Subsequently the patient died, after amputation, six weeks after he was admitted to hospital. The other two cases made uninterrupted recoveries following aspiration of the joint with the application

of extension and subsequent plaster, and I gather that both patients have good movable joints.

This, summarized, shows that of seventeen cases, three have gone on to amputation, and in two the patients have died. So that suppurative arthritis is fairly serious from the patient's point of view. It would appear from the figures, and from what I have seen, that a prompt and somewhat conservative treatment of these cases yields better results than a drastic opening of the joint. In my view the application of extension is a very valuable thing, as it acts not only as a splint securing rest to the joint—the limb should be slung in a Thomas' splint—but it also keeps the joint surfaces apart, and allows the cartilages to receive adequate nutrition, which is not the case if spastic muscles allow those surfaces to be pressed together. If, then, the condition does not look as if it will settle down, aspiration should be performed daily, with due aseptic precaution. I never like to see a joint light-heartedly aspirated in an out-patient department.

If drainage has to be performed, that is to say, if the joint does not settle down after one or two aspirations, I think a simple incision to the outer side of the joint, in front of the biceps tendon, laying the whole joint open, is the best course. I do not believe in washing out the joint; this, besides washing away the synovia with its bactericidal and nutritional powers, will tend to spread infection in some cases, to areas at the time free from it; and incision permits of adequate drainage and is always followed by a fall in the temperature and a gradual improvement in the case.

Another interesting point was the frequency with which a positive blood-culture was present in these cases—that is to say, in nearly every case the blood and the joint yielded the same kind of organism. Dr. Box told me that in the scarlatinal cases the organism in the joint is the same as that recovered from the throat of the patient, sometimes it is a long-chain streptococcus, sometimes the short-chain kind, sometimes the *Str. viridans*, but it is the same in joint and throat.

Therefore the general condition of the patient, as well as the local condition, calls for consideration.

The last point I want to touch on is the question as to why penetrating wounds of joints, whether treated by excision of the wound or not, do not often proceed to suppuration. Of the six punctured wound cases at St. Thomas's Hospital three were treated by excision and three by extension only, with no local treatment directed to the wound, and the result was good in both series.

Mr. V. H. Ellis: Acute suppurative arthritis of the knee-joint is not a common condition, and I doubt if there are as many as three or four cases a year in most London Hospitals.

On considering those cases with which I have come in contact, I am struck by the greatly varying results after apparently similar treatment. As this appears to be associated with the mode of infection of the joint, I will begin by classifying the condition on this basis.

Methods of infection of the knee-joint: (1) From without: Penetrating wounds of the joint, including surgical operations. (2) Blood-stream infection: (*a*) As primary manifestation; (*b*) secondary to a single focus, e.g., a boil; (*c*) as a result of a general blood-stream infection, the so-called pyæmic joint. (3) Extension of local disease (e.g., osteomyelitis).

However good the results of suitable treatment of suppurative arthritis may be, the most optimistic surgeons will agree that prevention is more desirable, and it is in the first class which I have mentioned that prophylactic treatment is most frequently possible.

In Rose and Carless's "Textbook of Surgery," pyogenic infections of joints are divided into three stages: acute synovitis, acute suppurative synovitis, and acute pan-arthritis. Although these stages are quite arbitrary and the condition passes

insensibly from one into the next, yet they are useful in indicating the pathology of the condition and drawing attention to the mechanisms of resistance which it must be the aim of any method of treatment to help and accentuate.

In considering the pathology of the condition, the important part played by the synovial membrane must be remembered. All the serous membranes of the body possess great bactericidal powers. Surgeons have now learned to trust this power to a great extent when dealing with the peritoneal cavity, but they are still chary of putting any great trust in the synovial membranes.

The first stage in any acute infection of the knee-joint is hyperæmia of the synovial membrane, which produces an exudate, at first serous, then fibrinous, and finally purulent. In all three of these stages this fluid is bactericidal. I have seen a fluid only slightly turbid aspirated from an early case of suppurative arthritis of the knee in which there were present almost as many streptococci as polymorphonuclear cells, and yet this fluid proved sterile on culture, showing that all the bacteria were dead. It would, therefore, seem logical to suppose that in an ideal method of treatment this bactericidal power of the effusion would be used to advantage.

In the case I have mentioned, when extensive incisions had been made on either side of the patella, and the joint had been washed out, the fluid contained many live streptococci, as proved by culture, and that in spite of the then much greater numbers of polymorphonuclear cells present.

It is, however, the change in the articular cartilage, produced by the infection, which is the key to the progress of the case, and it is here that our knowledge of the pathology becomes less secure. Destruction of the articular cartilage is the certain forerunner of ankylosis, either fibrous or bony, and though life may be saved, the case must be considered a failure if the joint is functionless.

The articular cartilage may be stripped from the bone in the course of a few hours, and unless we know the cause of this, treatment at this stage can only be empirical.

The blood-supply of the articular cartilage is meagre—it may be almost non-existent—and it is probable that most of the cartilage's nutritional requirements are supplied by the synovial fluid. We have noticed how rapidly the constitution of the synovia changes, and this change may account for the rapid death of the cartilage, apart from presence of toxins and lysins. If this is the case, irrigation by washing away and diluting the synovial fluid may further jeopardize the life of the cartilage.

It is not to be imagined that I am adversely criticizing the traditional treatment of suppurative arthritis, which I shall discuss presently: I am pointing out what appears to me to be a flaw, treating the subject from an ideal but purely theoretical standpoint.

As a further extension of this idea, I should like to bring to your notice the reports by R. Grégoire, in the *Bulletins et Mémoires de la Société Nationale de Chirurgie*,[1] of one or two cases, treated by simple incision of the knee-joint, evacuation of the pus, and the daily injection of a bacteriophage, with apparently very successful results, though the discussion, on the first case, at any rate, was not very friendly. Insufficient numbers of cases have as yet been treated by this method, but it is suggestive.

Before considering the treatment, I will describe the course of a typical case, and its gross pathology.

In the course of a few hours, frequently without any history of injury, the knee becomes swollen and painful, as in a hyperacute synovitis. The joint is distended with fluid and is hot and tender to the touch, and even the slightest movements are extremely painful. The patient feels extremely ill, and there is considerable fever.

[1] 1931, lvii, 373.

The limb is held slightly flexed, but the muscles are in spasm: sleep is grossly interfered with, as unconsciousness causes relaxation of the muscles, producing slight movement of the joint, which is very painful. The patient is wakened and the muscles once more are thrown into spasm.

As the condition progresses, the tension of the fluid increases until the capsule gives way and the pus travels either to the surface or deeply into the muscle planes of the thigh. The tissues round the joint are thickened and œdematous, and eventually fluctuating abscesses appear.

Meanwhile, the synovial membrane, at first hyperæmic, becomes converted into granulation tissue, the effusion grows more and more purulent, and the articular cartilages become affected, this being recognized by the occurrence of starting pains at night. The infecting organisms spread into the crucial and other ligaments of the joint, which become softened and stretched, so that displacement of the tibia backwards on the femur occurs.

The constitutional symptoms are severe, with high fever and rigors, and marked toxæmia, which may be fatal. If the condition is not fatal, recovery is almost always associated with ankylosis in bad position, or with a chronic suppurative condition in which the bones forming the joint are involved.

Treatment.—Acute suppuration due to wounds of the joint is not common in civil practice, as the well-known prophylactic method of excising the wound, cleaning the joint and suturing it without drainage, is extremely successful, and almost the only failures are due to delay in operation or in gross fouling of the joint.

The prognosis in any case is serious, and the mortality is not low, but the risk to life in the absence of other complications is very much lower in the case of blood-borne infection, and it is when we come to the pyæmic infection of the knee that the outlook becomes more remarkable, especially as regards the subsequent function of the limb.

That suppurative arthritis due to external wounds is especially grave is proved by the fact that at one London teaching hospital three successive cases of wounds involving the joint, which were not sent up for admission until a pyarthrosis was present, were all fatal.

Suppurative arthritis of the knee is not a common complication of osteomyelitis, because the latter is a disease chiefly of childhood, and in these cases the epiphyseal cartilage forms a barrier to the spread of the infective process. When it does occur, however, the great increase of toxic absorption occurring in an already very ill child, often necessitates amputation as a life-saving measure. It is interesting to note that the sterile though sometimes opalescent effusion so frequently present in the knee in cases of osteomyelitis of the neighbouring bones, never seems to give rise to any adhesions in the joint, injury to the articular cartilage, or stretching of the ligaments of the joint.

The generally accepted method of treatment of suppurative arthritis of the knee-joint in vogue to-day is associated with the name of Willems,[1] who combined wide arthrotomy of the joint with early movements to promote drainage. This treatment was also advocated by Everidge[2] during the late war.

The usual method of opening the joint is by two long incisions parallel to the patella, one lateral and one medial and extending upwards to open the subcrureal pouch. Counter-incisions towards the popliteal surface may also be made on the inner and outer sides. In severe cases some surgeons advocate division of the patellar ligament, so as to lay open the whole of the front of the joint. Drainage tubes are inserted down to but not into the joint, unless all hope of obtaining any subsequent power of movement has been abandoned.

Opinions vary as to the amount of irrigation that should be practised, but I

[1] "Manuel de Chirurgie de Guerre," 2nd ed., 1917.

[2] *Lancet*, 1920, ii, 273.

think all surgeons are agreed that movement drains the recesses of the joint better than anything else, particularly if the patient can be persuaded to move the joint actively. My own experiences in this with a child have not been very successful, and the alternative of repeated movement under anæsthesia has considerable disadvantages in a very sick child.

When considering the treatment of pyæmic arthritis, particularly that kind which arises suddenly, insidiously, and frequently almost unaccompanied by pain, the desirability of wide opening and drainage is not nearly as certain. Many surgeons content themselves with aspiration; others do not even relieve the tension of pus in the joint.

Perhaps some will say that in discussing pyæmic cases I am going beyond the subject of *acute* suppurative arthritis, but such cases, especially in puerperal patients, can arise with startling suddenness, and I think on that account alone merit inclusion.

Of far more importance is the interesting light which these cases may throw on the whole problem.

Frank pus often containing live organisms greatly distends a joint, yet that joint is often not excessively painful and frequently recovers with a large degree of useful movement, whereas in cases due to other modes of infection there is excessive pain and the joint becomes rapidly disorganized. It is the reason for these very dissimilar results that I should like to hear discussed, because it may have a great bearing on the future treatment of the condition.

Mr. R. W. Butler: Acute infection of the knee-joint following that of neighbouring bones is commonest after infection of the femur. Of eleven cases at St. Thomas's Hospital nine followed infection of the femur, one infection of the tibia and one infection of the patella. In five of the femoral infections the lesion was primarily limited to the epiphysis.

Acute suppuration in the knee-joint occurs, very rarely, as part of a general pyæmia following scarlet fever, and is then usually associated with acute middle-ear infection. Transitory joint symptoms occur in about 3·5% of scarlet fever cases, but true suppuration is rare.

Many penetrating wounds of the knee-joint in civil life, when they are treated early, escape suppuration. In ten years only three out of twenty cases at St. Thomas's Hospital went on to generalized joint infection.

Suppuration in a gonorrhœal knee occurs only occasionally. There are no exact figures for the knee, but the statistics of Wehrbein in America suggest that about 2% of all gonorrhœal joints proceed to suppuration from a superimposed pyogenic infection.

With regard to general treatment, it is important to differentiate between the primary septicæmic type and that with only local infection. In the former the infecting organism should be ascertained as soon as possible. If it is a streptococcus the injection of antistreptococcal serum helps some cases. Such septicæmic cases should not be subjected to unnecessary trauma or deep anæsthesia.

With regard to treatment it should be remembered that though synovial fluid when freshly secreted is bactericidal, it becomes when stale an excellent culture medium.

Early and repeated aspiration should therefore be carried out, and when frank pus is present free escape must be allowed by incisions.

Keep a strong traction on the leg to pull the joint surfaces apart. Besides relieving pain this is of greater value in the final retention of mobility than complicated attempts to obtain active movements in the early days of the infection.

In a series of thirteen end-results from St. Thomas's Hospital, rather over a third obtained a good range of movement, about a third became ankylosed and the remainder obtained some movement of doubtful utility.

To retain mobility is very desirable, but this will be useless unless the range of movement is strong and painless. It is certain that some knee-joints which retain mobility after a suppurative arthritis do not remain useful throughout life, eventually becoming painful and arthrodesis being then indicated.

The Chairman said that all the speakers had emphasized the value of the anti-bacterial powers possessed by the synovial fluid, and this was one of the most important factors which should influence treatment. Mr. Butler, however, had made the additional point that only when it was fresh did the synovial fluid possess this power. That constituted one of the arguments in favour of aspiration, which removed the stale fluid, with the bacteria—whether dead or alive—and permitted fresh synovial fluid to be discharged into the joint. The other important thing was to relieve tension. The synovial fluid had a paramount influence over the infection while that infection was retained within the joint. A knee-joint would burst and spread purulent fluid up the thigh and down into the inter-muscular spaces of the leg very easily if it was allowed to remain tense for long. That constituted a further reason for early and repeated aspiration. By aspirating one left the synovial membrane, most of the time, free to discharge fresh—and therefore bactericidal—fluid into the joint, and thus interfered as little as possible with its physiological function.

He was glad that no one had referred to the use of rubber tubes. He thought that very few surgeons nowadays would use drainage material, and that represented one of the advances in the treatment of joints; openings were made into a joint, but no rubber tissue was inserted, and so the synovial membrane was unhampered by foreign bodies.

Also, he thought that to refrain from washing-out of the joint was a great advance. He had once enthusiastically washed-out a heavily infected joint over a considerable time, and had been completely disappointed by the result. In the instance he had in mind, there had not been very bad infection, but the prolonged washing-out led, by painful stages, to amputation. He was now convinced that cases of the kind treated by excision of the wound, without washing and without drainage material, did much better.

Mr. Ellis did not seem quite sure whether he liked movement of the joint or not. He, the Chairman, had had experience of two cases recently; they were not exactly instances of acute arthritis of the knee-joint but that condition was threatened—there was turbid fluid in the joint, following a compound fracture of the femur. Morning and evening the knee was passively flexed a few degrees, the extent increasing day by day. That had led to better drainage and to an earlier resumption of active movement. Both those cases had done very well, but as they were only two, not much argument could be based upon them.

Mr. Mitchiner continued to speak of "extension" when he obviously meant putting on a Thomas' splint; he would probably agree that extension without a Thomas' splint would be an unsatisfactory method.

Mr. E. G. Slesinger said that he had appreciated the speeches of the openers, because it helped discussion to hear something which one could disagree with. He (Mr. Slesinger) spoke as an advocate of movement, not the half-hearted movement evidently believed in by some of the openers. He was an advocate of the kind of movement carried out during the war, which he considered as satisfactory in civil life as it was then. Also, he advocated extension, not with a Thomas's splint, but with a Finochietto stirrup, with sufficient pull to do away with the contraction of the muscles. He thought the function of the joint was improved by moving, and that the condition of the patient reacted favourably to opening the joint, putting on real extension—enough completely to separate the joint surfaces—and encouraging the

patient to move the joint actively. The latter did not constitute a difficulty if there was enough extension. If that was carried on under electric heating and with the limb on a bed with fracture boards and a light dressing, satisfactory results ensued.

Another point which had interested him in the discussion was a comparatively minor one. A speaker alluded to doing something to a joint under light anæsthesia or with no anæsthesia at all. He would like that member to reflect on what was the value of an anæsthetic; it was the only possible means of producing antisepsis in the blood-stream. That applied most particularly to pneumococcal cases. If a patient with pneumococcal septicæmia was placed under chloroform anæsthesia—the chloroform was held in a concentrated form round the blood-cells at the point of residence of the pneumococcus, and in concentration adequate, not to kill the microbe, but to prevent its multiplication by division. If one took blood from a patient who was under chloroform anæsthesia and put pneumococci into it they would not grow. He regarded the anæsthetic—and particularly chloroform—as a valuable therapeutic measure in any septicæmic condition, as it was the only means of producing an antiseptic condition of the blood. There was need for a full investigation of gaseous antiseptics.

He hoped that the opening speakers, in their reply, would say whether they were advocates of real movement, or of fixation, because that was the problem which the orthopædic surgeon was up against.

Mr. H. Osmond Clarke: The clinical picture of acute suppurative arthritis has probably changed little since the writings of the older surgeons, notably those of Thomas Smith in 1874, and there is not much to add to them.

In this generation there has been, however, the exceptional experience of penetrating injuries of the knee-joint gained during the Great War. Such are rarely encountered in civil practice, and it does not follow that the treatment advocated for joint infection following gunshot injuries is applicable to the less formidable suppurative arthritis of metastatic origin. During the past six years no penetrating wound of the knee-joint treated early in the orthopædic service of the Ancoats Hospital, Manchester, was followed by joint infection.

Incidence.—The relative incidence of pyogenic arthritis in various joints reviewed in a series of fifty patients is shown in the following table:—

TABLE I. Total—50.

Knee	...	...	20	Ankle	...	...	4
Hip	...	...	13	Shoulder	...	...	2
Elbow	...	...	9	Wrist	...	...	2

These figures confirm the accepted view that the knee is the most frequent site of acute suppurative arthritis. In 50% there had been a recent mild local injury, and in 25% a history, or visible sign, of a possible distant primary focus of infection.

The age incidence is wide, as would be expected in a general hospital series. It ranges from 10 months to 41 years, with the majority between 5 and 14 years of age.

Diagnosis.—Two important points in the diagnosis require emphasis. (1) In our series in the majority of patients examined in the early stages, a short range of painless movement was possible; complete fixation by muscle spasm was present only in the few severe infections, or in those joints in which pus had been overlooked for some days. Thus the absence of complete fixation by muscle spasm does not negative a diagnosis of acute suppurative arthritis, in the knee-joint at least.

(2) To avoid delay we insist on the immediate puncture of every suspicious joint, and have found examination of the fluid withdrawn a great help in diagnosis and treatment.

Methods of treatment.—Adequate drainage and temporary immobilization of the joint are established without delay. It is useful to examine a direct film of the aspirated material, but a delay of forty-eight hours for the result of culture is not permissible; at the end of that time the culture may be sterile, while in the meantime organisms have thriven in the excellent medium afforded by the turbid, stagnant synovial effusion.

(1) Drainage.—In deciding which of the two procedures—repeated aspiration or arthrotomy—is adequate in a particular case, a reliable guide can be found only in a careful consideration of the clinical picture of local and general signs.

(*a*) Repeated aspiration.—This procedure is frequently effective in patients in whom there is only a slight rise of temperature and pulse-rate, and in whom the fluid from the joint is turbid, contains few pus cells, and few or no organisms on smear or culture. In our series seven cases belong to this category.

If the general condition deteriorates, if swelling and tenderness of the knee increase, and the pus becomes thicker and organisms more numerous during the next twenty-four hours, it is unwise to persist with aspiration.

(*b*) Arthrotomy.—Arthrotomy is carried out when there is a severe general reaction—particularly a rapid pulse-rate, when local swelling, tenderness and muscle spasm are marked, and the pus is thick and rich in polymorphonuclear cells and organisms, and when it is impracticable to continue with aspiration.

(i) Anterior drainage.—Successful drainage has been achieved in eleven of this series by opening the joint through two parapatellar "stab" incisions, situated close to the lateral synovial reflections, washing out débris by saline irrigation, and closing the short skin wound, with a thin strip of corrugated rubber as a drain down to the unsutured capsule.

If the patient is eating and sleeping well, and the pulse-rate remains below 110, infection is being combated successfully; if local swelling and tenderness are not increasing, and the popliteal space remains flat, drainage is satisfactory.

In our experience this limited type of arthrotomy is equally effective in children and adults.

(ii) Combined anterior and posterior drainage.—It was necessary in two cases to drain the posterior pouches additionally. Tenderness, swelling and œdema in the popliteal space indicated the need for this procedure. The anterior incisions were prolonged backwards, the capsule was widely opened, and the menisci and tendon of the popliteus removed without complete division of the internal and external lateral ligaments. The wounds were not sutured, and successful drainage followed. We believe this method is more adequate than a transverse arthrotomy in severe infections.

(2) Immobilization and dressings.—Dressings are carried out not oftener than twice or three times each week. We employ fixed traction on a Thomas's splint during the early acute stage, believing that this is sounder practice than immobilization in plaster-of-Paris. When it is apparent that the joint is settling down it has been our custom to encourage attempts to mobilize actively; this procedure not infrequently caused a return of muscle spasm, necessitating a further period of traction. Hence, at the end of about the first two weeks we now fix the joint in a non-padded plaster-of-Paris splint for a further three or four weeks, and allow the patient to walk about freely. This régime has the following advantages:—

(i) It affords rest to the thickened, infected synovial membrane.

(ii) Severe muscle atrophy is prevented, and the nutrition of the joint and limb approaches the normal more closely.

(iii) If by reason of articular damage it is suspected that future mobility is unlikely or undesirable, bony ankylosis is more readily achieved. Where there has been no gross destruction of cartilage, mobility is not restricted eventually. Out of seven cases in which this procedure was adopted, in six the patients regained full movement, and bony ankylosis occurred in one.

Mobilization treatment.—In this series *immediate* active mobilization after arthrotomy, as advocated by Sir William Bennett in 1909, and later practised by Willems and Everidge, has not been tried. Most observers who have given the method a fair trial are unconvinced of its efficacy in maintaining mobility, and all are agreed on the difficulties for patient and attendants. In 50% of Everidge's patients varying degrees of mobility were retained. Comparison of this figure with those of our own and other series treated by temporary immobilization does not indicate any real advantage in the method, nor are we certain that it is sound in principle.

TABLE II.

			Movement		Ankylosis		
RESULTS:	Total	Death	Full	Partial	Bony	Fibrous	Amputation
	20	2	10	4	3	1	—

In one of the two fatal cases the patient died from puerperal septicæmia, of which the arthritis was a complication; in the other a diffuse streptococcal cellulitis was the primary lesion, which eventually caused a fatal septicæmia. In both, at the time of death, the joint suppuration had subsided completely after drainage.

The number of patients who regained varying degrees of movement is surprisingly large; recovery of normal joint function occurred in ten, in seven of whom the joint infection settled down after repeated aspiration; in the remaining three a limited arthrotomy was sufficient. Four patients regained partial mobility—three a range of 90° after anterior arthrotomy, and one a range of 20° after combined anterior and posterior drainage.

Bony ankylosis occurred in three joints; in one after severe infection demanding anterior and posterior drainage. In the other two pus had been present for some days before treatment; efficient drainage, as shown by satisfactory diminution of the general and local reaction, followed a limited arthrotomy, but the wounds discharged pus for some weeks. Attempts at active mobilization always resulted in spasm and contracture; the joints therefore were kept immobilized and bony ankylosis occurred.

The one example of fibrous ankylosis followed injudicious efforts, elsewhere, to increase a short range of movement by repeated forcible manipulations under anæsthesia. An arthrodesis of the joint has been necessary since.

Results of treatment in their relation to the methods employed are shown in the following table:—

TABLE III.

		Results		
Method of Drainage	No.	Movement	Ankylosis	Death
Aspiration	7	7	—	—
Arthrotomy→Ant.	11	6	3	2
↓ Ant. and Post.	2	1	1	—

The absence of complete fixation by muscle-spasm does not negative the diagnosis of acute suppurative arthritis, in the knee-joint at least.

We insist upon immediate puncture of all suspicious joints, and we have found examination of the fluid withdrawn a great help in diagnosis and treatment.

Mr. H. A. T. Fairbank said that there were two main classes of cases of suppurative arthritis in the knee-joint: (*a*) those which had a source of continuous or often-repeated infection; (*b*) those which had not such a source. During the

war these two types were constantly met with; on the one hand, cases with a major compound fracture of femur or tibia, the fracture extending into the joint, and on the other, those with a simple infected wound of the joint, with or without a foreign body, or a minor injury to the bones. The second class, if adequately dealt with, would probably recover without the loss of the limb; the first, however, almost invariably ended in amputation. It was impossible to remove the bone on one side of the fracture and thus leave an irrigatable surface: the joint was being reinfected from the fracture all the time.

With regard to the ordinary cases met with in civil practice, the difficulty was to decide whether to aspirate, to incise, wash out and close the joint, or to drain it. Every aspect of the case must be carefully weighed—the temperature, the leucocyte count, and the general condition of the patient. Surgeons occasionally had anxiety about knee-joints which they had opened because of some innocent cartilage displacement. In one such case the pathologist reported that pus was present but was quite sterile. In that case aspiration, repeated two or three times, ended in complete recovery.

On the other hand, there were cases in which, apparently, the knee-joint was infected from some remote focus—which could be called septicæmia if one wished, but it was not the ordinary clinical septicæmia—and which gave rise to some anxiety. One thing which might help was a smear examination of the pus from the joint. If there were few organisms, and those mostly intracellular, he would be tempted to try washing out the joint and sewing it up afterwards. But if the organisms were numerous and not for the most part intracellular, he would be inclined to drain.

The question of œdema was an important one. If much œdema was present it was an indication for drainage rather than for more conservative measures. If drainage was decided upon, it should be thorough.

He believed that what he was taught by his old chief, Mr. Stanley Boyd, over thirty years ago, was still sound, namely, that to drain a knee-joint one must make two long antero-lateral incisions and two short postero-lateral incisions. He was taught to make an incision on each side, from the top of the supra-patellar pouch down to the tibia, and to aim at making the skin incisions a little further back than the reflection of the synovial membrane from the femur, so that there was no tendency to the formation of a shelf on which pus could lodge. He also drained the posterior pouches on either side. He did not put in any tubes, or, at the most, put one down to the joint, not into it, through the postero-lateral incisions.

One or two references had been made in the discussion to epiphysitis of the knee-joint, but in his experience infection beginning in the epiphysis was excessively rare, except in infancy. In only one case had he seen it in recent years, and that was in a boy, aged 14, who clinically had obvious osteomyelitis of the femur. He (the speaker) cut down on the diaphyseal side of the epiphyseal line, but found nothing, so he prolonged the incision downwards into the internal lateral ligament and found pus in the epiphysis. Later the joint was drained, and two days later he thought the leg should be amputated. Mr. Wilfrid Trotter, however, thought that this operation should be deferred. Although two days after this the boy was apparently dying, he eventually recovered, after a sequestrum had been removed from the inter-condylar notch.

Mr. Mitchiner (in reply) said that he meant "extension" in the same sense as Mr. Slesinger did, i.e., a heavy extension, using the Thomas's splint merely as a sling for the limb, resting the limb on the Thomas's splint and taking a fairly heavy extension over the end of the bed. For a child of 5 or 6 years of age he used a weight of 7 or 8 lb., and he found that this was sufficient to keep the articular cartilages well apart. For an adult he used any weight up to 20 lb., the exact weight being determined by the degree of muscular development of the patient.

That was sufficient to relieve the pain and stretch the muscle. But, he asked, how were patients to be persuaded to move their knees? [Mr. Slesinger: By inserting a little novocain in the joint.] How did they lift the weight? [Mr. Slesinger: Quite well, if it were not on a Thomas's splint.] He (Mr. Mitchiner) thought that moving about in bed, with the requisite nursing, was sufficient movement for the average acute joint.

He had wished to make it clear in his paper, that he had much faith in the resistance of the synovial fluid. He did not advocate more than aspiration unless aspiration failed, as shown by deterioration in the general condition of the patient. It was only when he saw this indication that he opened the joint. He did not open beside the patella, but in front of the biceps, and from behind, so as to ensure drainage from the most dependent part of the joint.

He did not encourage early movement unless the patient was willing. The patient who moved early would emerge with a good joint, but his, the speaker's, experience of forced movements in these cases was that they would result in a painful joint, and it was better for the patient to be left with a fixed joint which was free from pain, than to have a movable joint which was painful.

Section of the History of Medicine.

President—R. O. MOON, M.D.

[*May* 3, 1933.]

Gastro-enterology and Metabolism : A Historical Survey.

By A. P. CAWADIAS, O.B.E., M.D., M.R.C.P.

THE historical development of a branch of medical science has to be described with the object of understanding the basic principles of that special branch. We study the past so as to be able to understand the present and forecast the future. History of medicine is medicine more than history. It is not a hobby but a method of approach to the scientific problems of the day. It is the most perfect method of approach to these problems, and the ancient Greeks used the term *ανιστόρητος*, " lacking in history," as synonymous with ignorant.

This being, in my opinion, the spirit in which history of medicine must be studied, it is on the evolution of ideas that we must concentrate, and for this reason I shall not give in this paper special biographical or bibliographical researches. I shall get hold of the two leading ideas of gastro-enterological and metabolic science and shall follow the development of these ideas through the centuries.

Three periods can be distinguished in the history of gastro-enterology and metabolism, the ancient period which begins with the first great physicians in the sixth century B.C. and extends to the end of the eighteenth century of our era, the period of the nineteenth century, which terminated with the Great War, and the Neohippocratic or contemporary period.

The Ancient Period.

In the fifth century B.C. the basic ideas of gastro-enterology and metabolism, the idea of the digestive factor in disease and that of the dyscrasic—or, as we say to-day, metabolic—factor in disease, were introduced. The whole of the subsequent work consisted in the development of the pathology of nutrition in the setting of these ideas.

The idea of the digestive factor in disease was introduced by Euryphon of Cnidos. It took at once the form of the theory of digestive toxæmia. Euryphon showed that disease—the Greeks, even the Cnidians, spoke of disease in general—was determined by the accumulation of foods in the digestive organs and the " rising " of these foods to the head.

The idea of the metabolic or dyscrasic factor in disease was introduced by Hippocrates the Great. For him the basis of disease was the disturbance in the normal mixture of the four cardinal humours—yellow bile, black bile, phlegm and pituita. A corollary conception was that of the " physis," namely, that the mixture of these humours was regulated by an inner force (the physis), and that in disease this force endeavoured to bring the disturbed humours to their normal state.

These two basic conceptions, in which Euryphon and Hippocrates crystallized the work of the Greek physicians previous to the fifth century, have a more remote origin. They represent the rationalization of the mystical religious intuitions of the old Mediterranean peoples.

The Greeks, the first Nordics,[1] brought with them a general conception of life different from that of the ancient Mediterranean peoples, Assyrians, Babylonians, Egyptians, Jews. These peoples believed in the supernatural intervention of gods and demons in nature. For the Greeks such intervention did not exist, and all happenings in the world could be explained by rational natural laws. Thus, disease for the ancient Mediterranean peoples was due to the intervention of gods and demons, and for that reason they had no science of medicine, but a healing art made up of superstition and magic mingled with rough empiricism. For the Greeks disease was a natural phenomenon that could be explained by natural laws; there was thus no necessity for supernatural intervention, but the natural laws of disease had to be studied so as to enable man to fight it. The Greeks created medicine.

Although, however, the Greeks banished from their life the irrational, or super-rational, they could not banish it completely, and much in their science consists in the rationalization of the mystical religious intuitions of the ancient Mediterranean peoples. One of these intuitions consisted in the assertion of the identity of man and the world as a whole—in Paracelsian terms, of the microcosm and the macrocosm. Now, when Empedocles describes man as constituted by the four elements, air, water, earth, fire, he simply rationalizes that mystical intuition. The four humours of Hippocrates, and thus the origin of the doctrine of the dyscrasia, the metabolic factor in disease, are based on these four elements of Empedocles, and so originate from the mystical conceptions of the Egyptians.

The same super-rational mystical origin is found in the Euryphonian conception of the digestive factor in disease. It is well known that, basing their methods on religious and mystical conceptions, the ancient Mediterranean peoples, Egyptians and Jews, introduced dietetic prescriptions. The Greeks took over from them these dietetic prescriptions, but endeavoured to place them on a rational basis. The first physician appearing in history, Pythagoras (sixth century B.C.), took his vegetarianism from the Egyptians. The subsequent work on diet of the Sicilian school dates from Pythagoras and it is this study of the influence of diet in disease that is the origin of the Euryphonian conception of the digestive factor in disease.

It is fascinating to watch at the dawn of human thought the struggle between Apollo and Dionysos—particularly in the frame of our art—the mutual interference of the rational and the super-rational.

Let us now follow the development of the conception of the digestive factor in disease during this whole ancient period of medicine, comprising the ancient Greek medicine and the first centuries of Western medicine.

This conception of the digestive factor in disease was perfected by the knowledge of the details of the digestive disturbances. Hippocrates himself, his Coan colleagues

[1] The Greeks represent the first stock of the Aryan-Nordic race that migrated into Europe. Probably during the third millennium B.C. they colonized what is known to-day as Greece, which was then inhabited by autochthonous Mediterraneans. The Greeks settled in Greece, coming in waves representing various tribes, the Pelagians first, then Achaeans, Aeolians, Ionians, Dorians. There is a certain similarity between the settlement of the Nordic-Aryan stock in Greece and the settlement of the same stock in the British Isles. The Dorians, according to Professor Bury, can be compared to the Normans, because they also organized, from the military and administrative points of view, the tribes which had settled before their coming.

The ancient Greeks had the physical attributes of the Nordic race. They were blonde and blue-eyed. This type disappeared later, partly because of the influence of the climate but mainly on account of mixing with the autochthonous Mediterranean races. Even in our days, however, by a sort of atavism many children in modern Greece are blonde up to the age of twelve or thirteen and become brown afterwards. Gobineau expressed the opinion that the loss of the Nordic type is a sign of racial degeneration and shows the influence of the autochthonous Mediterraneans. Kretschmer, however, finds in the mixture of Mediterraneans and Nordics in Greece, and of Nordics and Celts in the British Isles, a condition for the production of a race of genius and power. At all events, the Nordic Greeks brought with them a different conception of life; their spirit was essentially realistic, whereas that of the Mediterraneans was more contemplative and mystic.

and pupils and the Cnidian physicians, developed the clinical aspect of digestive disorders. In the Hippocratic works are found remarkable descriptions of dyspepsia, enteritis, and liver disturbances. Clinical description was pushed to a very high degree of precision by the empirics—that great group of physicians who dominated ancient medicine from the third century B.C. to the second century A.D., and who studied sedulously the symptomatological manifestations of digestive disturbances.

The anatomical and physiological discoveries of the sixteenth, seventeenth, and eighteenth centuries, helped also towards a greater precision, although the results were not very apparent during these centuries. Those discoveries constitute the basis of progress in the study of digestive disorders during the nineteenth century.

Hand in hand with the clinical and physiopathological development of the Euryphonian conception of the digestive factor in disease, the therapeutical outlook was also developed. Dietetics which, as we have said, were first studied by the Greek physicians of Sicily, reached a high degree of perfection with Hippocrates who, in his treatise "On Ancient Medicine," says that if it were not necessary for patients to feed themselves otherwise than as healthy individuals, medicine would not have existed. Asclepiades (100 B.C.) also developed dietetics. The subsequent centuries did not bring forth anything new; on the contrary, the science of diet which had reached such an important stage of development in ancient Greek medicine, was nearly forgotten. It is only towards the end of the nineteenth century that we find greater progress on this point.

The ancient physicians also introduced purgatives and emetics for the treatment of the digestive factor in disease. These methods were used by the ancient Egyptians and Jews, but the Greeks rationalized them. Faithful to their great sense of measure, the ancient Greek physicians did not fall into the exaggerations, from the point of view of application of these methods, that we find, particularly in the seventeenth century—exaggerations which rightly merited the satire of Molière.

The dyscrasic or metabolic factor of disease did not develop among these ancient physicians from a clinical descriptive point of view, as much as the digestive factor. There were not many exact methods of research in metabolism; work in that branch could be done only on the basis of speculation, and the ancient Greeks did not like speculation. They placed the doctrine of dyscrasia and of the physis in the background and busied themselves with careful clinical observation and treatment based on that clinical observation. The only point of speculation arises from the fact that Erasistratos the Alexandrian (295 B.C.) placed the metabolic factor not in a disturbance of the humours but in a disturbance of the solid constituents of the body, and later Asclepiades of Bithynia (100 B.C.) developed the same point of view by placing more precisely the metabolic factor of disease in a disturbance of the pores between the atoms. However, even Erasistratos and Asclepiades kept their theories in the background and gave to metabolic pathology treasures of anatomical, physiological, clinical and therapeutical research.

It is, in fact, from a therapeutical point of view based on clinical observation that progress is made. To help that inner worker, the physis, so that the metabolic equilibrium might be re-established, Hippocrates introduced the physical methods of treatment and thus became the originator of what is to-day called physical medicine. Apart from diet, he laid stress on exercise, on the action of water, of sun, of air and climate. Asclepiades also developed along these lines and insisted on water and sun treatment. Medicines were used very sparingly by the Hippocratists, because the mode of working of medicines was not known and the ultra-rationalistic Greeks did not like to grope in the dark. Hippocrates used various methods of elimination, bleeding, purgatives, emetics, diaphoretics—all, however, with that great sense of measure, the *μηδὲν ἄγαν*, inspired by the severe scientific discipline of clinical

observation. He used also medicines which acted either because they were contrary to the disease or because they were similar to the disease. We find in Hippocrates the two methods of pharmacotherapy known by the unsatisfactory terms of allopathy and homœopathy. Faithful, however, to this same sense of measure and of clinical observation, Hippocrates did not insist more on the one than on the other. He did not admit any universal law, except that of clinical experience, as sole criterion of medical practice.

We must reach the sixteenth century to find greater progress from a clinical descriptive point of view regarding the metabolic factor in disease. Paracelsus (1493-1541), one of the greatest reformers of medicine, introduced the method of chemical exploration and thus laid the foundation of modern metabolic research. Van Helmont (1577-1644) showed progress in biochemistry, also that important element of research concerning the metabolic factor in disease and introduces the gravimetric idea into the analysis of urine. Thomas Willis (1621-1675) made a further advance in the study of urine, particularly from the qualitative point of view. Sylvius (1614-1672) worked on the same lines and introduced the conception of acidosis. Sanctorius (1561-1636), professor at Padua, did perhaps the most important work of that period regarding metabolism. He discovered the insensible perspiration and placed the study of metabolism on the basis of precise measurement. Lavoisier (1743-1794), completing the work of John Mayow of Oxford, crowned the metabolic work of these centuries by demonstrating the rôle of oxygen and carbon-dioxide in vital combustion.

The historian of medical thought is struck by a certain difference, regarding this development of the metabolic factor in disease, between the work of the ancient Greek physicians and that of the iatro-chemists and the iatro-physicists of the sixteenth, seventeenth and eighteenth centuries. The ancient Greeks had no real chemical methods. They were careful not to fall into speculation and developed intensively the therapeutical work, particularly regarding the introduction of the methods of physical medicine in metabolic disorders. The physicians of the sixteenth, seventeenth and eighteenth centuries had better biochemical methods and discovered certain important facts of metabolism, but not possessing the moderation of the ancient physicians, they lost themselves in a maze of metaphysical speculations and completely neglected therapeutical work. From the point of view of treatment I have to repeat what I said regarding digestive disorders; there is a definite setback during these centuries. Bleeding only survived and was applied to a degree unknown among the ancient Greeks. All the others—the real Hippocratic methods—the methods of physical medicine, were entirely forgotten and the careful drug treatment of Hippocrates was replaced by violent methods, strong doses of purgatives, emetics and other poisons.

The Nineteenth Century.

Owing to neglect of the Hippocratic methods, of careful clinical observation, of severe scientific logic and of concentration on therapeutics, the end of the eighteenth century was marked by a sort of malaise. Something had to occur to shake our science out of its learned lethargy and to stimulate it to further progress. This work of awakening and stimulation was accomplished by the introduction of a new principle unknown to the Greeks, the principle of the localization of disease. The principle was false, but served to guide research into new channels.

While the principle of localization was being introduced and was getting hold of most physicians, another principle, which had fallen into oblivion since the time of the Greeks, was introduced by Hahnemann, the principle of individual diagnosis and careful treatment according to the law of similarity. This principle developed only amongst a limited group of physicians.

To understand the development of the two leading ideas we are discussing—the conception of the digestive factor and that of the metabolic factor in disease—we must first describe the general trend of medicine during the localistic period. Three distinct phases have to be noted in the nineteenth century, the anatomical, the physiological and the bacteriological.

The first phase of this period is purely anatomical and nosographical. What physicians like Corvisart (1755-1821), Laennec (1781-1826), Cruveilhier (1791-1873), the great men of Guy's Hospital and the physicians of the new Vienna school, did in the beginning of the nineteenth century was to describe types of disease based not only on symptomatology, as had been the case since the Cnidians, but on anatomical lesions. This purely anatomical phase could not last long, because through it the science of medicine became stunted into a classification of morbid categories similar to the classifications of zoology and botany.

To the anatomical phase succeeded the physiological phase, which originated in the work of Magendie (1782-1855), Claude Bernard (1814-1878), Johannes Müller (1801-1858). Magendie first showed that before the lesion there must be a disturbance in the physiology, in the functioning of the organ, and that thus the study of the lesion could not be the basis of medical work. This idea was developed by Claude Bernard, but did not find any direct application in France or in England at that time. It found, however, important application in Germany, and thus originated the German physiological school of the middle of the nineteenth century.

At its beginning this physiological school was anti-nosographical and anti-clinical, and for this reason France and England, countries of clinicians, did not join in that movement. What the first German reformers like Wunderlich (1815-1877), Ludwig Traube (1818-1876), Henle (1809-1885), looked for was, first, the destruction of the morbid categories of the types of diseases, and next the replacement of the clinical approach to disease through laboratory experimental work. It is obvious that on this basis the movement could not succeed. Although "diseases" are fictions and were introduced as fictions for purposes of classification by the Cnidians in the fifth century B.C., such "diseases," such morbid categories, are necessary, because without classification there is no knowledge, and without knowledge no cure. Neither could the anti-clinical spirit succeed. Since the days of the "rationalists," Diocles of Karystos and Praxagoras of Cos, that is, since the fourth century B.C., all attempts to do away with clinical observation and to find another "rational" basis for the science of disease have ended in failure. The German physiological school began in the flush of enthusiasm for anti-clinical rationalization, but had to admit in the end that without clinical observation no progress in medicine could be made.

A sounder spirit was introduced into the work of the physiological school, and was marked by the publication in 1880 of the *Zeitschrift für klinische Medizin*, under the editorship of Frerichs (1819-1885) and Leyden (1832-1910). The authors did not abandon nosographical classifications, but study of the lesion which served as the basis of these classifications had to be supplemented by the study of the functional disturbance of the organ. Clinical observation remained as the principal method of medical research, but the anatomical diagnosis of the condition of the organs had to be supplemented by the study of the functional condition of these organs.

With the discoveries of Pasteur (1822-1895) nineteenth century medicine took another swing towards progress. The ætiological principle was introduced. Diseases were no longer described on the basis of the anatomical lesion or of the functional disturbance, but on that of the cause, the microbe that determines these lesions and disturbances. Clinical diagnosis no longer consisted solely in finding out lesions or anatomical disturbances, but also consisted in discovering the microbe at the origin of the morbid condition.

Regarding the development of the digestive factor in disease during the complicated nineteenth century, a high point of precision is reached from a descriptive point of view.

The digestive factor in disease became dismembered into various definite anatomo-clinical syndromes. Gastric ulcer, which had been already described in the sixteenth century by Scultetus and Marcellus Donatus, of Mantua, and later by Matthew Baillie (1799) and John Abercrombie, was studied with great accuracy as a nosographical entity by Cruveilhier, who differentiated it from cancer, and later by Rokitansky (1841). Duodenal ulcer was described by Bucquoy much later, in 1887, but its description reached its highest degree of exactitude with the work of Moynihan, who by his *Pathology of the Living* placed the anatomical study of disease on a new and more precise basis, and also with radiological research. Cancer of the stomach was differentiated by Cruveilhier, and Brinton, one of the pioneers of gastro-enterology, described plastic linitis. The study of gastritis remained at first in a sort of nebula, and it is to the work of Hayem in the nineties that its development is due.

The work of Moynihan and of Hayem was done after the purely anatomical period of the localistic phase of disease and during the time when the physiological and bacteriological spirit was introduced into gastro-enterology. Physiological studies were rich in results regarding the development of digestive disorders. Kussmaul in 1867 employed the stomach pump for the treatment of dilatation of the stomach, and remarked that it could be used also for diagnosis by judging the functioning of the stomach from the contents obtained by means of the pump. William Leube, in 1871, made a further advance by proposing the test meal. From that time onwards important work in the chemistry of the gastric juice was done, especially when Ewald, in 1875, replaced the older stomach pump by the softer Faucher tube. In Kussmaul's clinic in Strasbourg, van der Velden showed in 1879 the absence of free hydrochloric acid in cancer. Reichmann of Warsaw studied hypersecretion in 1882, his ideas being developed by Bouveret of Lyons. Hayem in Paris did important and painstaking work on gastric digestion, which he studied in its various phases, thanks to the serial test meal which he introduced towards 1890. With the introduction of the softer and more practical tube of Rehfuss, these researches continued, particularly with the work in this country by Izod Bennett and Ryle.

This physiological work brought far greater precision into the science of the gastric diseases than the purely anatomical, but there occurred a certain setback on account of the exaggerated use of gastric chemistry. Albert Robin, himself a great biochemist, protested against these exaggerated views, and showed the fallacy of basing everything on gastric chemistry. With the advent of better methods of anatomical exploration, the *Pathology of the Living* of Moynihan, and principally the methods of radiological exploration, the anatomical study was once more established as the most precise basis for the study of gastric disorders.

During the last phase of the localistic conception of disease (the bacteriological phase) the ætiology of gastric and, particularly, of intestinal diseases, was greatly developed by the discovery of specific agents in certain intestinal conditions (cholera, dysentery), and also, thanks to the doctrine—true in certain cases, but exaggerated in others—of focal infection.

Progress regarding the metabolic factor in disease was not so great during the anatomical phase of the nineteenth century. In fact, no anatomical lesion could be found for such metabolic disturbances, and it was only later on that anatomical description became possible in the study of metabolic disorders, with the discovery of the rôle of the endocrines, regulators of metabolism, by Brown Sequard, and particularly with the conception of pancreatic diabetes introduced by the clinician Lancereaux, and confirmed experimentally by Mering and Minkowski.

It was during the physiological phase of the nineteenth century that greater progress in metabolic disorders was made, owing to the introduction of precise biochemical methods. This progress began with the work of Bouchard, but developed tremendously with more exact technique. The work of the Therapeutical Clinic of the University of Paris—under the inspiration of Albert Robin—the work of the schools of Naunyn, Friedrich Müller, Magnus Levy, the work of Gowland, Hopkins and other British workers on vitamins and that of the American students of nutrition, Chippenden, Benedict, O. Folin, Graham Lusk, O. Attwater, marked important milestones in the study of metabolism, and thus in the development of the Hippocratic idea of the metabolic factor in disease.

The Contemporary or Neohippocratic Period.

A crisis similar to that which characterized medicine towards the end of the eighteenth century occurred during the years prior to the War. The principle of the localization of disease and the bacteriological conceptions had yielded all that they had to give—a great deal for diagnosis, very little for treatment. The need for re-estimation of values was again felt. For further progress another path had to be struck, and this was done by the introduction of the principles of Neohippocratism, which approaches the synthetic conceptions of the ancient Greek physicians.

As always happens when modern principles are introduced, their formulation varies with different scientists, and there is a tendency towards one-sided and erroneous interpretations of the Neohippocratic principle. I think that the safest and most helpful formula of Neohippocratism for medical research and practice must adhere to the conceptions of the school of Cos.

The Neohippocratic principle is that according to which disease is of the whole body and mind, the local lesions or functional disturbances being only terminal and partial manifestations of the general disease. Disease is an expression of the mode of reaction of the body-mind unit to certain modified external conditions and represents the effort of that unit to adapt itself to those conditions.

The practice of medicine, according to the Neohippocratic principle, consists in a triphasic act which is essentially individualistic, considering the patient and not the fiction "disease." (*A*) The syndrome diagnosis, in which local lesions and functional disturbances are considered, but also the general metabolic syndromes and the ætiological constellation. (*B*) The diagnosis of the person, in which the individuality of the patient and the individuality of his reactions are considered. (*C*) The choice of remedy, based sometimes on the organ manifestations but more frequently on the general metabolic syndromes and on the personal reactivity, made with the object of helping the defensive powers of the body-mind unit. For this choice the Neohippocratic physician considers medicines that are "either contrary or similar" according to the teachings of clinical observation, the sole criterion of Neohippocratic practice.

Thus Neohippocratism brings us back to another movement, that of Hahnemann —although on different lines. It is curious to remark how the histories of individuals and of nations, as of ideas, show certain similarities. At a certain period a special turning is taken and no reason can be found why that and not another turning has been taken. At the onset of the nineteenth century two new principles were offered to medicine, that of the localization of disease and that of Hahnemann. Medicine chose localization.

Nowadays, we turn rather towards the Hippocratic conception of the general and individual disease, and Hahnemann comes more into the foreground. We come back, however, to the Hippocratic and Hahnemannian conceptions richer than we were at the end of the eighteenth century. During the nineteenth century medicine had abandoned the straight road traced by the ancient Greeks. It had wandered

along a by-path, but during these wanderings it gathered treasures and, rich with these treasures—anatomical, physiological, bacteriological—medicine comes back to the straight road.

During this contemporary or Neohippocratic period of medicine great progress has been made regarding the metabolic factor in disease. By the study of disturbances of metabolism, on the basis either of biochemical investigations or of more careful symptomatological exploration such as was shown by Hahnemann and by Sir James Mackenzie, the pre-organic phase of disease is diagnosed and treated. Thus the modern trend of medicine, the Neohippocratic trend, consists in the finding in every disease of that element of dyscrasia which for Hippocrates is at the origin of every morbid condition.

The digestive factor in disease is also being developed in this Neohippocratic phase of medicine, and its development becomes more and more intimately connected with the metabolic factor. In fact, general metabolic disturbances are being found at the origin, for example, of gastro-duodenal ulcer. Thus, Bergmann shows the importance of the disturbance of the parasympathetic nerve, some Budapest workers like Balynt show the rôle of pH disturbances, others show the rôle played by the parathyroids, and so on.

The treatment of digestive and metabolic disorders also is being placed on a new basis. The local lesion or disturbance is now treated by the stimulation of the general therapeutical reactions of the body-mind unit, by the action of the physis—in other words, as we can say with greater precision to-day, by the action on the neuro-endocrinic mechanisms which control the functions of organs and cells. Thus the old Hippocratic therapeutical methods are being reintroduced. Dietotherapy is carefully applied, psychotherapy is developed and studied scientifically, biological immunizing methods, thanks to the pioneer work of Sir Almroth Wright, find great scope for application. The procedures of physical medicine are making brilliant advances. Last but not least, the therapeutical agents of mineral or vegetable origin, that is, drugs, are being employed with greater success because the mechanism of their action is better understood in the spirit of the general immunizing processes and the technique of their application is becoming more precise.

These are the broad outlines of the historical development of gastro-enterology and metabolism. The origin of this branch of medicine is lost in the mystical intuitions of the ancient Mediterranean peoples. With the ancient Greeks the real foundation stone is laid with the two leading ideas, those of the digestive and of the metabolic factors in disease, and these two ideas develop in parallel. With the nineteenth century a great work of detail and of technique separates various morbid conditions, diseases of the stomach, the intestines, the liver, the pancreas, and diseases of the organs of metabolism. With the Neohippocratic period the digestive and metabolic factors are united, the rôle of the general metabolic disturbance in disease is developed, and we come once more, after so many adventures, to the Hippocratic conception of the metabolic disturbance as the basis of all disease and to the therapeutical methods originating from that conception, the constitutional, the immunizing methods of treatment.

Section of Dermatology.

President—A. M. H. GRAY, C.B.E., M.D.

[*May* 18, 1933.]

Two Cases of Acrodermatitis Atrophicans Herxheimer.—HUGH GORDON, M.R.C.P.

I.—Patient, female, aged 40.

History.—At her first pregnancy, twenty years ago, she noticed blueness and swelling round both ankles. This has gradually spread up both legs.

During twenty years she has had four pregnancies, and on the occasion of each she has noticed a marked exacerbation of the condition, which has been more or less quiescent in the intervals between the pregnancies.

No subjective symptoms are complained of except pain in the right knee; which appears from the X-ray examination to be due to osteo-arthritis.

Present condition.—The skin of both legs is seen to be strikingly abnormal up to the inguinal folds in front, and to above the buttocks behind. Behind, the abnormal area fades off gradually into the normal skin. The colour of the skin is bluish-violet, and in many places the superficial veins can be seen through the epidermis with abnormal clarity. Below both knees there are islands of normal skin, interspersed with infiltrated areas which almost give the impression of forming small tumours in places. The epidermis, particularly round the knees, is wrinkled, with the typical "cigarette paper" appearance. Round the ankles the blue colour is more marked, and there is a feeling of slight induration without, however, it being sclerodermic in consistency. The Wassermann reaction is negative.

Histological report (by Dr. R. A. E. Klaber) on section from an indurated area above the left knee, stained by Weigert's stain:—

"The section shows hyperkeratosis overlying an atrophic epithelium. The corium in its upper third shows rather a dense, uniform, small round-celled infiltration. In its lower two-thirds the elastic tissue is profuse, swollen, and in some places broken. No collastin can be recognized. The appearances are those of a fairly early stage of an idiopathic atrophy."

II.—Patient, female, aged 43.

History.—Five years previously a small bluish area appeared in the left palm, about the size of a half-crown. This gradually spread till it has covered the whole hand up to the wrist. No subjective symptoms are complained of.

Present condition.—On comparison of the two hands, a well-marked difference is seen. The left hand does not show the characteristic "cigarette paper" appearance; it is more glistening than that of the right hand, and has a tendency to be wrinkled The degree of atrophy present is definite although slight. The superficial veins are much more clearly seen than are those in the right hand. The Wassermann reaction is strongly positive.

On clinical examination, the patient's central nervous and circulatory systems appear to be normal. Her husband is alive and well, and she has one healthy son aged 24. There have been no miscarriages. There is a history of an "ulcerated womb" nine years ago, and "ulceration" of the legs. There is, however, no typical scarring on the legs. Unfortunately, no section was obtainable.

The first case appears to be an absolutely typical case of acrodermatitis atrophicans Herxheimer, which, from the history, one can assume to have, in this case, an endocrine causation.

In the second case, however, although the clinical picture is less well marked, it is interesting to note that there is a strongly positive Wassermann reaction.

Pautrier, who has shown about thirty cases in all of this disorder at Strasbourg, found that in only four there was a positive Wassermann reaction, which, in his opinion, was a coincidence. Milian, on the other hand, is of the opinion that many of these cases of idiopathic atrophy have a syphilitic basis, possibly caused by the action of the syphilitic toxins on the endocrine system.

The second patient as yet has had no antisyphilitic treatment, and it will be interesting to note what effect, if any, such treatment has on the clinical condition. Should the condition clear up with any rapidity, it would appear to confirm Milian's supposition that idiopathic atrophy, even of the Herxheimer type, may have a syphilitic basis. If, however, the atrophy has progressed too far, obviously it may be permanent, and thus will vitiate any therapeutic test.

Dr. SYDNEY THOMSON, referring to the first case, said that Cushing had recently written about this condition but he did not think that a case had been shown in this country. The syndrome was apparently caused by a basophil tumour of the pituitary gland. He had seen one such case in King's Hospital under Dr. Lawrence. The patient was of this general obese habit and had intermittent glycosuria, but she was not diabetic. She showed patches of purplish discoloration and telangiectases, with slight atrophy, on the legs, similar to the condition in this case. Patches of the same type were scattered about the body, and under the patches were indefinite subcutaneous thickenings suggestive of Dercum's disease, but by no means typical of that affection. The only other points about her were that she had a high blood-pressure, and that she looked much older than her actual age, which was 32. It might be worth while to reconsider the diagnosis in the present case from this point of view.

POSTSCRIPT.—(27.6.33). After five weeks' antisyphilitic treatment the condition of the second patient has improved very rapidly, and there is now not much clinical difference between the two hands [H. G.].

Mongolian Blue Patches.—J. D. ROLLESTON, M.D.

The patient, a girl, aged 2 years and 11 months, is the daughter of a Chinese father and English mother. She has areas of slate-grey pigmentation on the upper part of both buttocks, one on the right and three on the left and one in the internatal cleft. The child is dark-haired and dark-eyed and shows the typical features of a racial Mongol. There are six other children in the family—five boys and one girl, none of whom the mother states, present these patches. This was certainly true in the case of the youngest boy, aged 1 year, who was recently under my care for whooping-cough and showed no patches. The mother attributes their appearance in the present child to a fall which she had in the sixth month of pregnancy.

This is a typical case of Mongolian blue patches occurring in the usual situation in the child of a Chinese father, as in a case which I showed at a meeting of the Section for the Study of Disease in Children some years ago. As from 90 to 95 per cent. of racial Mongolian infants show these patches, their absence in the other five children in this family is very unusual. They are sometimes found in other races, so that some writers, e.g., Crookshank have objected to the term "Mongolian," but in European children they occur in only about 1 in 2,000 infants (Lauze). I recently saw a girl, aged 2 years and 3 months, the child of English parents, who showed a typical patch below the angle of the right scapula. She did not present any other features of the racial Mongol, and the mental condition appeared to be normal. There was one other child in the family, a girl, aged 4½ years, who had never had any patches.

Mongolian blue patches appear to have received more attention from pædiatrists than from dermatologists. The fullest accounts in English are to be found, in Crookshank's and Cockayne's works and in the translation of von Reuss's textbook.

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Xanthoma Tuberosum Multiplex (Fibro-xanthoma Multiplex).—SIR ALDO CASTELLANI, K.C.M.G.(Hon.), D.S.C., M.D., F.R.C.P.

Mr. T. H. S., aged 55. Occupation: regular Army and Post Office worker. During his career the patient has been in China, Singapore, South Africa (Boer War), Malta, Dardanelles and German and Portuguese East Africa (1917-1919).

He had malaria in 1897 and has had several attacks since; the last mild attack was seven months ago. No other illnesses.

He first noticed some nodules on the right knee in 1918, but says that they disappeared within about twelve months. Soon afterwards, nodules appeared on the fingers; they slowly increased in size, and others appeared. He now has large nodules, some of them lobulated and as large as a nut, on both hands (fig. 1), elbows,

FIG. 1.—Xanthoma tuberosum multiplex.

feet and buttocks, and a small one on his nose. They are hard, non-painful and non-pruriginous and have a yellowish colour.

General health good. Wassermann reaction negative. Urine: neither sugar nor albumin present. Stools normal; no ova of helminths or protozoa. Blood chemistry, sugar normal; urea, 33 mgm.% (normal); cholesterol, 265 mgm.% (greatly increased).

FIG. 2.—Section of a nodule stained with Weigert's iron hæmatoxylin and van Gieson.

Histopathology.—A notable feature is the enormous amount of fibrous tissue present (fibro-xanthoma).

In sections stained with Weigert's iron hæmatoxylin and Van Gieson, some typical xanthoma cells with characteristic foamy, honeycomb cytoplasm are seen (fig. 2).

Dr. ELIZABETH HUNT said that she saw this patient seven years ago, in Liverpool, when he consulted the late Dr. R. W. MacKenna. At that time the lesions were mainly confined to the palms and affected more particularly the lines of flexure of the joints; they were not so large as they are now, nor were they covered to the same extent with dilated capillaries. Thus the condition had become much worse in the interval.

Leprosy (Mixed Type).—A. C. ROXBURGH, M.D.

R. G., male, aged 59, a sorter in the General Post Office, is at present in St. Bartholomew's Hospital under the care of Professor F. R. Fraser, who has kindly allowed me to show him here.

History.—Two years ago left big toe nail fell off painlessly. Occasional "pins and needles" down outer side of left foot and numbness of skin of that foot. Occasional "pins and needles" down back of left forearm. One year ago, blister on left big toe-joint after wearing new pair of boots; septic, painless, never healed. One month ago, eyes and nose "running." Eruption of brownish macules on chest and back.

Past history.—Born in London. 1873. 1892-1898: In army in India. Soft sore and buboes; malaria, six months in hospital. 1899-1900: In South Africa (Boer War). 1901: Came home. Has not been abroad since.

Present condition.—Face wrinkled and lined. Slight nodular thickening of skin of forehead over eyebrows. Slight loss of hair of eyebrows. Eyes: Conjunctivæ injected, pupils irregular and unequal. Left smaller than right. Nose: clear discharge.

On the chest, back, arms and thighs there is an eruption of brownish macules up to 1 in. in diameter. These are slightly scaly, but not infiltrated, and show no change in sensation. There is slight thickening of the lobes of the ears. The left epitrochlear gland is palpable. There is an ulcer on the inner side of the left big toe over the metatarso-phalangeal joint, discharging yellow pus containing staphylococci.

Nervous system: Both ulnar and both superficial peroneal nerves thickened and tender. Sensation impaired over back of both hands, from wrists to level of metacarpo-phalangeal joints. Left foot: Complete anæsthesia to touch, pain and temperature over dorsum of foot and sole of foot except for the heel. Deep sensation: Position sense and vibration sense both normal.

Cerebrospinal fluid normal. Blood Wassermann reaction negative. Cerebrospinal fluid, Wassermann and sigma reactions negative. Smear from nasal secretion shows intracellular and extracellular lepra bacilli.

Microscopical sections from skin of left eyebrow and lobe of right ear show many lepra bacilli arranged in the typical manner. An interesting point about the case is the very long incubation period of about thirty years.

Dr. J. M. H. MACLEOD said that he regarded this as a somewhat advanced case of leprosy. It was rare to see an early cutaneous case with nerve lesions. Probably this patient had had symptoms for a considerable time before the disease was diagnosed. The small spots seen in this case were common when the disease was becoming generalized and were associated with some elevation of temperature (leprotic fever).

Lupus Pernio.—LOUIS FORMAN, M.D. (for Dr. H. W. BARBER).

Mr. A. D., aged 55, has consumed a bottle and a half of whisky a week for the past four years. Four years ago had a fistula-in-ano. Since October, 1932, has complained of shortness of breath and had attacks of bronchitis and asthma; has lost 7 lb. in weight during the past two months.

Six years history of affection of hands and feet. When seen at out-patients department two months ago, the skin of the fingers and backs of the hands was red and deeply cyanosed with a good deal of infiltration. The fingers were swollen, giving the appearance of spina ventosa.

There was some superficial scaling of the tips of the fingers. The same cyanosis and firm sharply limited infiltration, were present on the tips of the toes.

During the summer months the patient improves very considerably—the infiltration practically disappears, leaving some discoloration of the skin.

There is enlargement of the axillary and inguinal glands. The spleen is enlarged two finger-breadths below the costal margin and the liver has been found by different observers to be palpable both at the umbilicus and under the costal margins.

Examination of the lungs suggests fibrosis and consolidation particularly of the right upper lobe. The radiologist reports "large dense roots, with an enlarged gland at the right. There is extensive fibrosis of both lungs." Repeated examination of the sputum was negative for *Bacillus tuberculosis*.

An axillary gland was excised and Dr. Nicholson reported that it was infiltrated by a caseous and follicular tuberculous granulation tissue. Blood-count normal.

The patient was afebrile until injections of sodium morrhuate were given—2 c.c. of a 10 per cent. solution, intramuscularly every other day—when the temperature went up to 100·5° F.

A skiagram of the right hand shows two clear areas in the second phalanges of the first and second fingers.

Under treatment the infiltration of the back of the hands has practically disappeared, but superficial necrotic areas have developed on the dorsal aspects of the fingers

The reactions with tuberculin, bovine and human, 1/50 and 1/5000, are strongly positive (seen now on the arms). The injections were made three days ago. There was a febrile reaction of 104·8° F. eight hours afterwards.

Tuberculosis of the glands and the lungs is frequently associated with lupus pernio, though Kissmeyer, in his recent review, states that the incidence is not greater than that seen in a number of sick patients. Similarly the positive tuberculin reactions are, he says, neither more nor less than those found in a corresponding group of normals.

Discussion.—Dr. H. W. BARBER said that he regarded this case as of great importance. Clinically it corresponded to the lupus pernio type of Schaumann's benign lymphogranuloma, with enlargement of the lymphatic glands, spleen, and liver: he was not convinced about the presence of clear areas in the skiagrams of the bones. The von Pirquet reaction was, however, strongly positive, and the excised axillary gland definitely tuberculous. He thought that the necrosis that had occurred in the lesions on the fingers could be attributed to the injections of sodium morrhuate.

The PRESIDENT said there could be no doubt that this was a case of lupus pernio; the type of infiltration on the hand was very characteristic. The main thickening appeared to be subsiding. He had not previously seen a case with such necrosis on the fingers, but the type of necrosis was similar to that in a case illustrated by Schaumann (*Brit Journ. Derm. and Syph.*). The author of that paper pointed out the tendency in many of these cases for active tuberculosis to develop as a terminal feature, and said that when this stage was reached the cutaneous tuberculin reaction became positive. Even when there was no treatment the sarcoid lesions tended to disappear. The question was whether that was what was happening in this case. The necrosis had been very slow in this case, and it surprised him to see a reaction of that type following sodium morrhuate injection. He could not suggest any reason for the anomalous grouping of the symptoms, except a more active form of tuberculosis developing.

POSTSCRIPT.—The patient died 5.6.33.

Post-mortem examination showed caseous paraortic abdominal lymphatic glands. There was hyperplasia of the cervical lymphatic glands without evident tuberculosis. The lungs were emphysematous and contained a few miliary tubercles. The liver was fatty and contained a few small tubercles.

The spleen was enlarged to twice the normal size and a few small tubercles were seen. There was hyperplasia of the lymphatic follicles.—[L. F.].

Recurrent Erythema and Desquamation of the Palms.—LOUIS FORMAN, M.D.

Miss S., aged 39.

History (five years).—Every four weeks or so, the skin of the palms becomes yellow and then red and irritable, and after a week desquamates in large sheets. When first seen there was a patch of lichenification on the thigh which has cleared up under X-ray treatment.

Nothing abnormal found on general examination; basal metabolic rate + 15%; blood-uric acid: 3·7 mgm.%; blood-sugar curve shows definite lowered carbohydrate tolerance and patient has been put on a diet for the past three months.

Blood-sugar fasting, 0·13; 1 hour after 50 grm. of glucose, 0·235; 2 hours after 50 grm. of glucose, 0·222.

The patient had had applications of X-rays to the palms before I first saw her and has had arsenic by mouth and a course of whole blood injections, with no effect.

Examination of scrapings of the palms and the toes for fungus has had negative results.

Urticaria Pigmentosa.—A. BURROWS, M.D. (for Dr. W. J. O'DONOVAN).

Joan C., aged four months.

Has had a rash since she was three days old. It began with wheals over the body, and then blisters appeared containing clear fluid. These ruptured, leaving raw areas, which on healing are deeply pigmented.

The lesions are distributed over the face, trunk and limbs and vary a great deal in size; some being quite small and some several centimetres long.

Wassermann reaction negative. Blood-count: R.B.C. 5,000,000; Hb. 56%; W.B.C. 5,800; polys. 38%; small lymphos. 55·5%; large lymphos. 1·5%; large hyals. 5%.

Pathological report on a biopsy of a skin lesion: "Great infiltration of dermis with very numerous mast-cells and a few eosinophil leucocytes."

The child is generally in good health, is breast fed, and is gaining weight. There is no family history of dermatological abnormality.

Hodgkin's Disease of the Skin.—A. BURROWS, M.D. (for Dr. W. J. O'DONOVAN).

Sarah C., aged 37, a patient of Dr. Jupe at the London Hospital X-ray Department.

She had a mass of glands removed from the neck in 1927, and subsequently had X-ray treatment. She also had in 1933 a mass removed from under the chin at St. Andrew's Hospital; this was then called a lymphadenoma.

The patient is now under X-ray treatment at the London Hospital. She has a pink nodular infiltration at the root of the nose and in the adjacent region of the right eyebrow, and a large scar of the neck (see illustration). Enlarged glands are present in the left neck but not elsewhere.

Professor STOKES (Philadelphia) said that at the Mayo Clinic, he had seen two or three cases in which localized lymphœdema had developed after extirpation of lymphatic regional glands, and he had had the unhappy privilege of watching for two years a patient with Hodgkin's disease of the skin develop every type of lesion with which that disease had been associated in literature. He did not regard the present case as one of Hodgkin's disease: he thought that it was one of lymphœdema with secondary hyperplastic fibrosis, fibrous buttons. He had noted this condition, particularly in women who had undergone extirpation of inguinal lymph nodes, and he had seen it in both men and women who had deficient lymph drainage of the groin.

"Berlock Dermatitis" (Pigmentation).—W. N. GOLDSMITH, M.D.

N. L., female, aged 22, exposed herself sixteen days ago to strong sunlight for an hour and a half, after applying Eau-de-Cologne to the front of her neck and chest. This was the first time she had sunned herself just after applying Eau-de-Cologne. Pigmentation was noticed two days later. It has been fading recently. The skin had not been sweating before the application. Below the left clavicle is a horizontal streak of pigmentation with vertical streaks running down from it.

Comment.—The special point of interest is that this condition, so frequently mentioned in continental literature is so seldom, if ever, reported in this country. This is the first case I have seen. Rosenthal pointed out that there seemed to be some climatic factor as it was observed much more commonly in certain years and in certain countries than others. Zurhelle, who experimented in 1928 with various volatile oils in spirit, found that the dermatitis only developed if they were applied to skin that had been actively sweating, and under such circumstances it could be very intense. He considered that the well-known Eau-de-Cologne pigmentation was a sequel of such a dermatitis. Though the condition was first described as a pigmentation, the descriptive name of "Berlock dermatitis" given to it by Rosenthal in 1924, which has become universally adopted, also suggests that the pigmentation is preceded by inflammation. R. Kurz, who in 1929 produced pigmentation with Eau de Cologne followed by ultra-violet light, found histologically that the colour was not due to increased basal-cell pigment but to deeper coloration of the horny layer and attributes it to an oxidation process.

In my own case the patient is definite in her statement that the pigmentation was not preceded by any redness or roughness. As far as they go, these points support the explanation of Kurz rather than that of Zurhelle.

Dr. ELIZABETH HUNT said that the reports of such cases as this had suggested a possible method of treating leucoderma. She had tried Eau-de-Cologne and ultra-violet light in a severe case of leucoderma in a girl, but had had no success from it.

Disseminated Staphylococcal Granuloma.—A. M. H. GRAY, C.B.E., M.D. (President).

H. W., male, aged 49. The present condition began in June, 1932, with a small boil on the right side of the lower jaw; this did not clear up and was soon surrounded by a crop of smaller similar lesions. The condition gradually spread, chiefly over the beard region on the right side of the face and eventually travelled round to the left side. A number of hard, irritable lesions formed, tending to break down and discharge copious amounts of pus.

When first seen by me, in August, 1932, the condition was limited to the beard region and from the size of the lesions suggested a tinea of the beard. Repeated examinations, however, of the hairs and the pus failed to reveal any fungus. Cultures made also only yielded a staphylococcus.

Towards the end of August other lesions began to appear on the forearms and groins and on the upper part of the abdomen. These lesions consisted of raised,

dull red nodules in the skin, some of them the size of a threepenny-piece, and small points of pus became visible on the surface and burst from time to time. The lesions on the face became more or less confluent and not entirely confined to the beard region, some appearing in other parts of the face and on the neck. The patient has well-marked rosacea and a mild degree of rhinophyma with patulous follicles of the nose. He has had a considerable degree of conjunctivitis associated with small corneal ulcers, probably also of rosaceous origin.

The condition on the face has subsided to a certain extent as a result of treatment, including a few small X-ray exposures, but is still fairly active. The granulomatous lesions on the abdomen and forearms have, for the most part, subsided, but a fresh lesion has developed on the left shoulder—of the same type but much larger than those which have occurred in other parts of the body, and discharging pus through multiple openings. From the pus of this lesion *Staphylococcus aureus* only has been cultivated.

General physical examination showed no abnormalities, except a movable tumour on the left side of the abdomen which appears to be the spleen. This was first noted during an attack of trench fever during the War and has apparently remained ever since; it has certainly not diminished in size while under observation. The blood-count shows no abnormality. A Wassermann reaction on two occasions, once after a provocative injection of novarsenobillon, was negative. Nothing abnormal was found in the urine.

A series of skin tests were made by Dr. W. N. Goldsmith. The patient gave negative reactions to trichophytin and tuberculin, but gave a strong reaction to *Staphylococcus aureus*, the lesion produced being identical in appearance with the granulomatous lesion already existing on the forearm; it broke down and discharged pus in the same way. There was a slight reaction to *Streptococcus viridans* but none to a hæmolytic streptococcus. The patient has given a history of previous attacks of boils intermittently since the age of 15.

Innumerable examinations have been made of the hairs and pus from the beard region. On one occasion what seemed to be a fungus growth appeared in culture but it died out and subcultures failed. Later a monilia-like organism was found, but neither of these organisms was pathogenic.

The patient was put on potassium iodide rather over a month ago with a result that a considerable number of fresh pustules appeared on the face and forearms, many of which are still present and appear to be due to the iodide.

The case appears to me to be one of considerable interest and in my opinion is an example of a granulomatous staphylococcide. The clinical picture resembles very closely a case of trichophytide reported by Professor E. Bruusgaard in the *British Journal of Dermatology*, 1922, xxxiv, 150, but in this case we have entirely failed to find fungus. Further, the vigorous reaction to the staphylococcus cuti test, with the production of a lesion similar to those already existing, and the absence of any reaction to trichophytin, suggests strongly that one is dealing with lesions due to the dissemination of staphylococci in the blood-stream in a person whose skin is highly sensitized to the staphylococcus.

The particular interest is the lesion on the right shoulder, which is identical in clinical characters to the lesions found in that curious condition, acne conglobata. The nature of the latter condition is still in considerable doubt but there is a certain amount of evidence to show that it is probably also due to staphylococcal infection.

I have examined a number of sections stained to show organisms but have been unable to discover any. Some of the lesions have been inoculated into guinea-pigs, but with negative results. Two or three blood-cultures have been made, but no organisms have been grown.

Buccal Lupus Erythematosus.—H. C. SEMON, M.D.

Limitation of this disease to the mouth is exceedingly rare, and always offers some difficulty in diagnosis. In the patient shown (a widow, aged 55) there is a sore, roughly quadrilateral patch of the condition in about the centre of the right buccal mucosa, and measuring about an inch in its widest diameter. There is slight superficial ulceration, and also some cicatrization which has caused a tendency to depression below the surrounding surface—a very characteristic feature of the condition. A few telangiectases are present; the colour is red, with a mauve or bluish tint. The diagnosis of lupus erythematosus is supported by the fact that the patient had a patch of that condition on the scalp in 1928; I treated this with carbon dioxide snow, and the epilated atrophic patch can be clearly demonstrated in the left fronto-parietal region. A small scaly area in the left elbow region, in which scratching elicits parakeratotic scaling, may also be one of lupus erythematosus, as there is no other clinical evidence of psoriasis.

Multiple Fibromata.—SIR ERNEST GRAHAM-LITTLE, M.D.

The patient is a girl, aged 12, sent to me by Mr. Frank Juler, my colleague in the Eye Department, who was treating her for pseudo-pterygium of obscure origin, which dates from her earliest years, probably connected with a traumatic injury to the nose resulting in nasal sepsis. Quite recently there was an efflorescence of small, very numerous, hard tumours scattered over the body, on the average of the size of a split pea. One of these has been examined histologically and the section shows pure fibrous tissue without nerve-fibres or muscle constituents.

There are no subjective symptoms connected with the tumours, and apart from the eye condition the patient seems in normal health.

? Psoriasis in an Infant aged 2 months.—SIR ERNEST GRAHAM-LITTLE, M.D.

A female infant, aged 2 months, with an extensive eruption of isolated scaly patches on the chest, abdomen and the back of the trunk, all of which appeared within the last four days.

I believe this to be a case of psoriasis at an unusually early age, the earliest in fact at which I have seen the disease. The maternal aunt, who has come with the patient, also has definite psoriasis of the body and scalp, and she gives a history of the same condition being present in another sister.

Extensive Urticaria Pigmentosa.—SIR ERNEST GRAHAM-LITTLE, M.D.

The patient is a woman, aged 47, who has a very extensive eruption of urticaria pigmentosa which began five years ago and causes intense irritation. At present the hands, arms, forearms and large parts of the trunk and thighs are occupied by this eruption, which is one of the most extensive I have seen in an adult urticaria pigmentosa.

A section from one of the lesions shows characteristic filtration with mast-cells.

Section of Otology.

President—J. F. O'Malley, F.R.C.S.

[*May 5, 1933, continued.*]

Two Cases of Acusticus Tumour: With Clinical and Pathological Reports.

By Albert A. Gray, M.D.

CASE I.

Clinical Report.

(By Dr. Adrian de Kleijn.)

The patient, female, aged 21, was admitted to hospital on April 9, 1929, and died on September 26 of the same year.

Previous history.—Ever since her birth the patient had had trouble with her eyes, otherwise she was healthy. At the age of twelve she was sent to an asylum for the blind. Nine months ago menstruation ceased and about the same time she began to find difficulty in walking, her speech and hearing became affected and her blindness became complete. At the age of eight years she had a severe convulsion.

Condition on admission.—Patient was blind, deaf, indolent but contented and puerile. Osseous and muscular systems well developed. No evidence of anæmia. Enlarged glands in the neck. Pulse 82, regular, equal on both sides, but small. Blood-pressure 130/85. No albumin or sugar in the urine.

Peripheral nerves.—Not examined.

Eyes.—Patient quite blind. *Right eye*: No disc visible, but a silvery-grey mass is seen which is much larger than the papilla, is very prominent and is spindle-shaped. *Left eye*: The disc appears to be replaced by an ashy-grey mass without sharply defined margins. Here and there small blood-vessels run to this area from the nasal half of the fundus. The pupils are round, and equally dilated, and the reactions to light are reduced to a minimum on both sides. Examination of third, fourth and sixth nerve show indications of nystagmus, and on testing the functions of the fifth nerve it is found that, while the sense of pain is intact the corneal reflex has disappeared on both sides, and convulsions occur in the face on pricking with a needle. Pressure on the stems of the nerves does not cause abnormal pain.

There appears to be very slight paresis of the right facial nerve.

Examination of the eighth nerve shows that complete deafness is present on both sides and there is no caloric reaction on either side. The drum-membranes are intact. Taste not examined.

Tenth nerve.—When attempts are made to raise the palate, the right side of it remains immobile.

Eleventh nerve.—The trapezius muscle of the right side feels more flabby than that of the left.

Twelfth nerve.—The right side of the tongue is atrophic and shows folds in the mucous membrane, and fibrillar contractions occur. The tongue when lying in the mouth is deviated to the left, but when put out it deviates to the right.

The pharyngeal reflex is absent. The palate is high and narrow. The movements of the head are normal. The thyroid gland is not enlarged. The lungs appear to be healthy.

Examination of the sensory nerves cannot be carried out satisfactorily, but on examining the motor nerves it is found that on the left side the grip is stronger than on the right. The reflexes on the right side are stronger than on the left, but the sense of pain is greater on the left side.

Abdominal organs appear to be healthy and there is no increased sensitiveness of the ovary.

Legs.—The anterior surface of the tibia is curved and uneven (periostitis luetica ?).

Passive movements.—Slight hyperextension is perhaps present in both knee-joints. The patellar reflex is equal on both sides, but the tendo Achillis reflex is greater on the left. Babinski reflex present on both sides +. Sensitiveness to heat is diminished on the right side.

With the eyes closed: Romberg +; walking ataxic; cannot walk alone.

On performing lumbar puncture it is found the pressure in the cerebrospinal canal is high, 30 mm. at the beginning and 24 mm. at the end of the operation. Wassermann test, negative. Santo-Georgi test, negative.

X-ray photographs of the cranium show that the sella turcica is enlarged as are also the optic foramina on both sides but there is no erosion of the bone.

Examination on April 16, 1929. Oto-laryngological examination.—The right cord is fixed on phonation, while the left is freely movable. Tympanic membranes are intact. Syringing with very cold water produces no reaction.

On the afternoon of April 28, the patient collapsed, the pulse became small, the breathing irregular, cyanosis was present, and the patient became aphonic.

On May 16 drowsiness was very noticeable, but there was no vomiting.

On July 12 Rossolini test, right ? left +. Babinski +, and equal on both sides.

Oppenheim on both sides +. No paralysis. Abdominal reflexes diminished on both sides. Mayer test positive on both sides. There is no noticeable difference between the facial nerves on each side. The tongue lies in the mouth deviated to the left, but is deviated to the right when it is protruded, indicating a severe degree of paralysis of the right twelfth nerve.

August 16.—On ophthalmoscopic examination the disc is not visible on either side. An ashy-grey mass projects forward producing the appearance of detachment of the retina.

September 25.—The condition of the patient was serious, particularly in regard to respiration, and death occurred the following day.

Post-mortem examination.—The case was one of von Recklinghausen's disease, of the central type, there being no tumours on the peripheral nerves. There were typical tumours of the papillæ of the eyes, and of the acoustic nerve on both sides.

When the blood was examined (July 13) the result showed 4,700,000 erythrocytes and 81,000 leucocytes. Hæmoglobin 87%. There was a relative lymphocytosis.

Pathological Report.

Right ear.—The growth on the right auditory nerve extends into the internal auditory meatus and appears to fill it completely (fig. 1). The meatus itself is much wider than normal, owing to the dilatation of its walls by the pressure of the growth. At one point the growth appears to have eroded its way into the vestibule in the region of the macula sacculi. Although both cochlear and vestibular nerves are seriously involved in the growth the fibres have not been entirely destroyed, so far as the cochlear portion is concerned, and bundles of them can be seen entering the modiolus. The lower and the greater part of the middle whorls of the cochlea are free of the growth, but in the uppermost portion of the latter a deposit of tumour tissue is found in the scala tympani, and a similar deposit is present in the upper region of the modiolus, which is destroyed at this point (fig. 2). The ganglion spirale shows signs of degenerative processes, but nerve-cells are still present, though few in number. In the lower whorl no nerve-fibres are to be found running from the ganglion spirale to the organ of Corti, but in the middle whorl these fibres are still found. The organ of Corti appears to be normal from apex to

base of the cochlea, and such changes as are found are obviously due to post-mortem disintegration. The membrane of Reissner is normal in appearance and position.

FIG. 1 (Case I).—Right ear. *m*, tumour tissue in modiolus ; *t*, tumour tissue in meatus.

FIG. 2 (Case I).—Right ear. *m*, tumour tissue in upper portion of modiolus.

The vestibule and semicircular canals are free from any tumour tissue, with the exception of the minute area in the region of the macula sacculi above described.

In the bony capsule of the cochlea, immediately in front of the oval window,

there is a focus of newly formed bone, identical in every respect with that which is found in typical cases of otosclerosis (fig. 3). It is porous in texture, it stains more deeply than the surrounding normal bone, and the spaces are filled with bone-marrow. The lamination of the bony tissue is not so regular as that of the normal bone and the line of demarcation is very sharply defined. At one small area the new-formed bone has invaded the anterior crus of the stapes, thus causing fixation of the latter (fig. 3).

The stapedius muscle shows no sign of degenerative changes, and the same is true of the tensor tympani.

The cavities of the middle ear are filled with exudate containing numerous round-cells. This, however, is merely the exudate which so frequently occurs very shortly before death in the air-filled bony cavities of the nose and ear, and has no special pathological significance. The tympanic membrane shows no perforation.

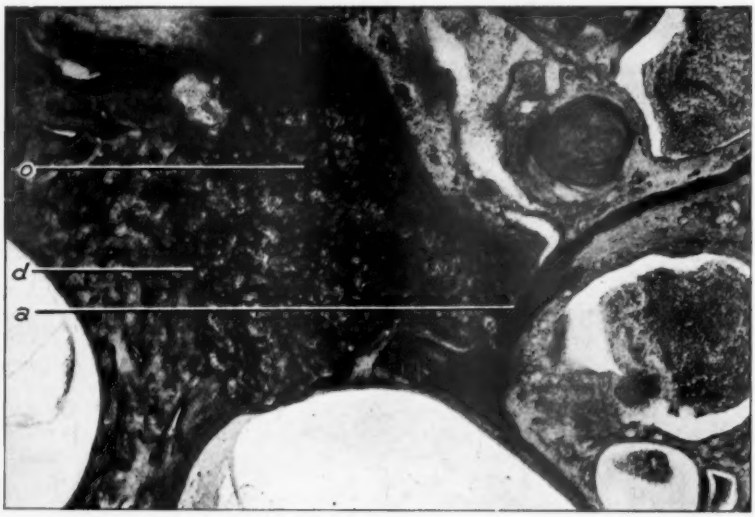


FIG. 3 (Case I).—Right ear. *o*, area of otosclerotic bone staining deeply; *d*, line of demarcation; *a*, region at which the otosclerotic bone has grown over and formed a union with the anterior crus of the stapes.

Left ear.—The left ear presents appearances very similar to those in the right. The internal auditory meatus is quite filled with tumour tissue (fig. 4), and its calibre has been increased by absorption of its bony walls, caused by the pressure of the growth. The cochlea of the left ear is not affected by the growth to the same extent as that of the right ear, the only point at which tumour tissue is found being in the scala tympani of the lowest whorl. The ganglion spirale has undergone almost complete degeneration (fig. 5), and nerve-cells are found only in the upper portion of the middle whorl, and even these are very few in number. The organ of Corti, however, does not show any sign of pathological changes in any part of its course, though naturally the usual signs of post-mortem disintegration are present.

The vestibule and semicircular canals are not affected by the growth.

In the bony capsule of the labyrinth, immediately in front of the oval window, is an area of newly formed bone (fig. 6), exactly similar to that which has already been described in the same position in the right ear. It is porous in texture and the

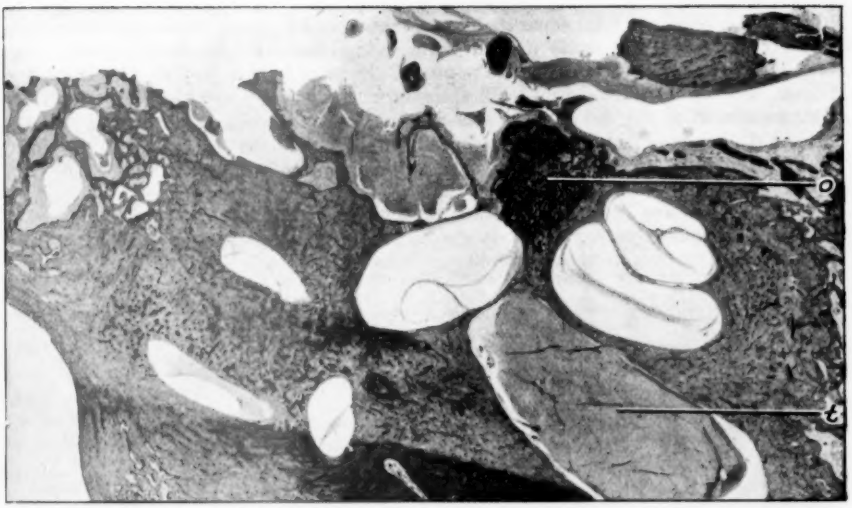


FIG. 4 (Case I).—Left ear. *o*, area of otosclerotic bone in front of oval window; *t*, tumour tissue in internal auditory meatus.

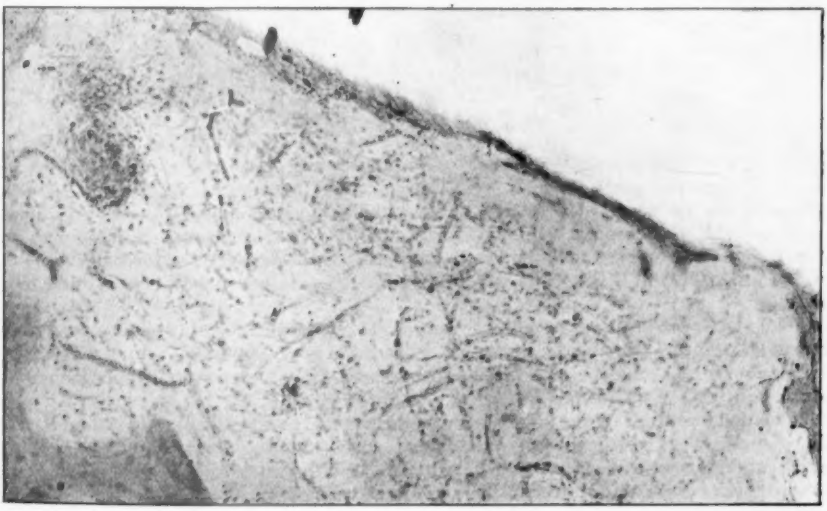


FIG. 5 (Case I).—Left ear. Ganglion spirale, from which all the nerve-cells have disappeared.

spaces are filled with bone-marrow. It stains more deeply than the normal surrounding bone, and is separated from the latter by a sharp line of demarcation. At no point does the newly formed bone extend across the stapedio-vestibular articulation, and consequently there is no ankylosis. In this respect, therefore, the left ear differs from the right. The newly formed bone is identical in appearance with that found in typical cases of otosclerosis.

The stapedius muscle is quite normal in appearance.

The tympanic cavities of both sides are free of pathological changes and both tympanic membranes are intact.

The tissue of the tumour is uniform throughout and in both ears. It consists of the usual fibrous tissue, which is found in these growths in multiple neurofibromatosis and is monotonously homogeneous in texture.

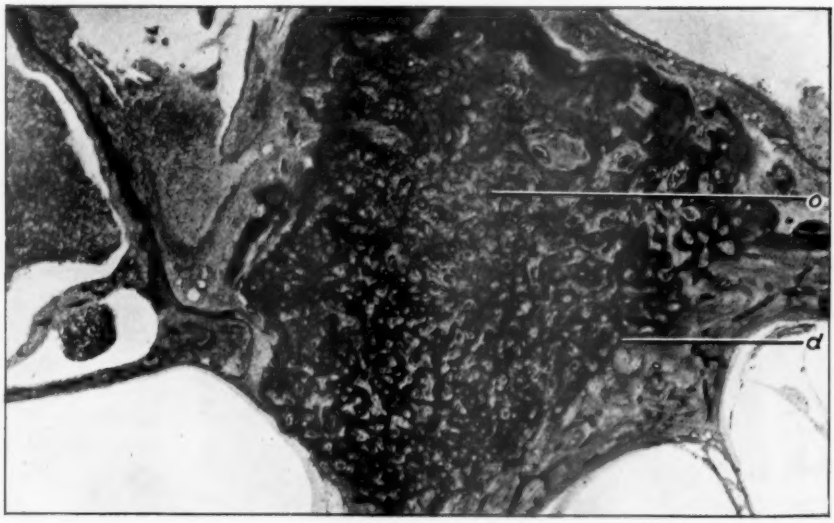


FIG. 6 (Case I).—Left ear. *o*, area of otosclerotic bone in front of oval window; *d*, line of demarcation.

All cases of acusticus tumour are interesting, and the present case, though the growth does not involve neighbouring structures to the same extent as that described by the writer in the *Proceedings*, June, 1932, xxv (Sect. Otol), reveals some interesting points.

The bilateral occurrence of the tumour is by no means so unusual as might be expected. The writer has had altogether three cases of acusticus tumour occurring in the course of von Recklinghausen's disease, and in every case the tumour has been present in both auditory nerves.

The degeneration of the cochlear nerve below the point at which it is involved in the growth is in keeping with Wittmaack's experiments on section of the cochlear nerve and demonstrates that this nerve behaves differently from the vestibular and other cranial nerves as regards the changes that occur when it is injured. The nerve-cells of the ganglion spirale had almost all undergone degeneration, and this is the usual result in cases of acusticus tumour. The organ of Corti appeared to be entirely unaffected, as is very frequently, but not always the case.

But what is by far the most interesting feature of the case is the occurrence of the focus of newly formed bone in the labyrinthine capsule on each side. It is identical in every way with that occurring in typical cases of otosclerosis, and is found in the same position as in that disease. In fact were the acusticus tumour not present it would be considered a typical case of otosclerosis from the pathological point of view. The question arises, therefore, as to what is the significance of these otosclerotic foci in this case, but this subject is referred to at the end of this paper.

CASE II.

Abstract of Clinical Report.[1]

(By F. C. Ormerod, F.R.C.S.)

M. C., aged 14. Small tumour removed from abdominal wall in May, 1931. In August, 1931, suffered from occipital headache and vomiting. Giddy on sudden movement. Occasional attacks of diplopia. Seen again in August, 1932, and admitted to hospital suffering from deafness and tinnitus in the right ear, and occipital headache. Sensation was normal except in the right cornea, which was anæsthetic. Vomiting occurred and there was bilateral papillœdema, but there was neither nystagmus or squint, nor was keratitis present. Tears are fewer on the right side. On examination on September 2, the *right* tympanic membrane was normal, but there was a considerable degree of nerve deafness on that side. The Rinne test was negative in the right ear, Weber test, to left. The upper tone limit was lowered. The hearing was normal to all tests in the *left* ear.

Caloric tests. — Right labyrinth inactive, left labyrinth showed delayed responses.

Pathological Report.

There were numerous small tumours under the skin. On examining the brain a tumour was found in the cerebello-pontine angle on each side. That on the right side was much the larger of two and was about the size of a small hen's egg, while that on the left was about as large as a cherry. There was considerable distortion of the brain in the region of the medulla and pons, both of these structures being pushed over to the left by the presence of the large growth in the right cerebello-pontine angle. The lateral ventricles and the fourth ventricle were very much dilated.

The *left* temporal bone only was available for microscopic examination. After hardening and decalcification it was embedded in celloidin and serial sections were cut and stained in various ways, and the following conditions were found. There were no pathological changes in the middle ear. There was a dislocation of the stapes inwards, but this was obviously produced post mortem when the temporal bone was being removed from the skull (fig. 7). In the cochlea the organ of Corti in the apical and middle whorls showed no evidence of disease (fig. 8), the changes found being fully accounted for by post mortem disintegration. In the lowest portion of the lowest whorl the innermost portion of the organ of Corti had been replaced by a deposit of tumour tissue and the row of inner hair-cells was destroyed. In the same region of the cochlea tumour tissue was found on the lower surface of the osseous spiral lamina, and it extended inwards along the wall of the scala tympani (fig. 8). The ganglion spirale in the upper and middle regions of the modiolus showed evidence of an early stage of degeneration in a few of the nerve-cells, but the number of the latter was not perceptibly less than normal. In the lowest portion of the lowest whorl, on the other hand, the degenerative changes were very striking (fig. 8). Most of the nerve-cells in this region had disappeared altogether, leaving a large number of empty spaces. In the comparatively few nerve-cells that remained degenerative changes were present in almost all, but

[1] *Proceedings*, 1933, xxvi, 566 (Sect. Otol., 18).

FIG. 7 (Case II).—*o*, area of otosclerotic bone, small in extent, in front of oval window; *f*, footplate of stapes, which was dislocated inwards during removal of the bone.

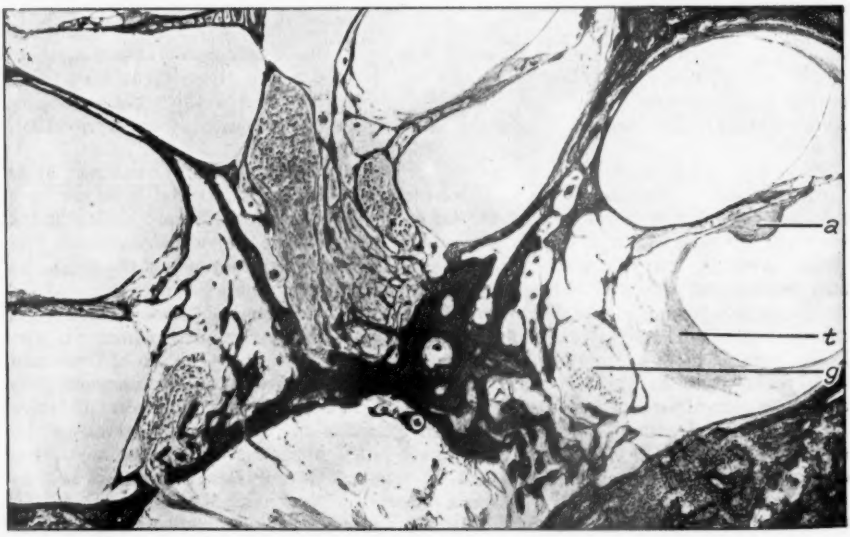


FIG. 8 (Case II).—*a*, tumour tissue (metastatic) on under surface of osseous spiral lamina; *t*, tumour tissue (metastatic) in wall of scala tympani; *g*, ganglion spirale in lowest whorl of cochlea. The nerve cells in this whorl have almost all disappeared, but in the middle whorl are seen to be almost normal in number.

there were a very few which appeared to be normal. It is important to observe that the region in the ganglion spirale where these degenerative changes were present was that into which run the nerve-fibres from that portion of the organ of Corti which was destroyed by the tumour tissue as described above (fig. 8).

One of the most interesting features of the case as revealed by the pathological examination was the existence of an area of otosclerotic bone situated in the region in front of the oval window (fig. 9). This newly formed bone showed all the appearances characteristic of that found in cases of otosclerosis. It absorbed hæmatoxylin stains with avidity and was porous in texture, and bone-marrow was present in the comparatively large spaces. The sharp line of demarcation was strikingly apparent, and there was no sign of round-cell infiltration. It occupied the position usually found in cases of otosclerosis, in front of the oval window. Indeed, had the appearances been found apart from the acusticus tumour, the case would have been

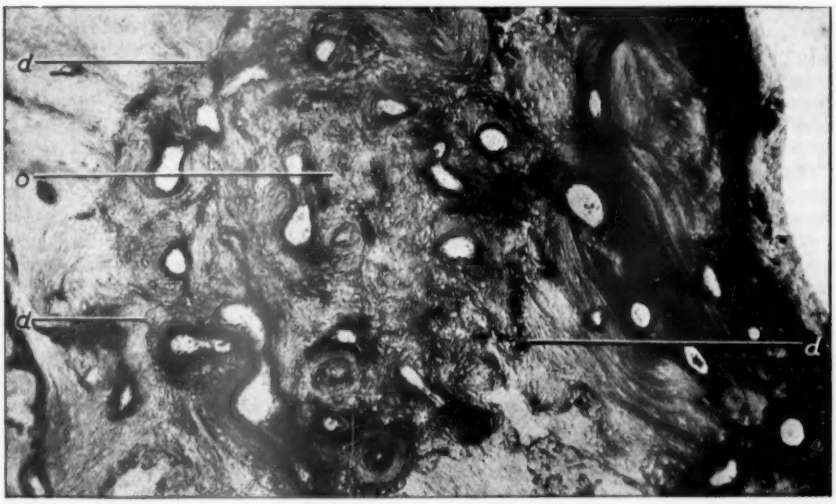


FIG. 9 (Case II).—*o*, area of otosclerotic bone in front of the oval window; *d*, *d*, *d*, line of demarcation.

described as one of typical early otosclerosis. The newly formed bone had not invaded the stapedio-vestibular articulation and consequently there was no ankylosis at that joint. The significance of this formation of otosclerotic bone will be discussed later in conjunction with the same condition which the writer has found in two other cases of acusticus tumour.

Apart from the presence of the focus of otosclerotic bone just described, the interest in this case lies in the fact that it gives us the opportunity of studying the effects of acusticus tumour in its very early stages. The large tumour on the right side brought about a fatal issue before the tumour on the left side had given any evidence of its existence except the delayed responses to the caloric test in the left ear. It must be remembered, however, that the hearing tests were made more than two months before the death of the patient. This probably accounts for the fact that when the hearing was tested that of the left ear was found to be quite normal, although when the patient died, more than two months later, the organ of Corti and the cells of the ganglion spirale in the lowest whorl of the cochlea were diseased.

But the amount of tumour tissue found in this region of the cochlea was very small, and might quite well have developed after the hearing tests had been made.

Another interesting element in this case is the correlationship of the negative Rinne in the right ear, as described by Mr. Ormerod in his clinical report, with the changes found on pathological examination. In this regard it is very unfortunate that the right temporal bone was not available for examination. But in view of the fact that an area of otosclerotic bone was found in the capsule of the left labyrinth in the usual place in front of the oval window, it is not making a serious assumption to infer that a similar area in a more advanced stage was present in the right temporal bone. For it must be remembered that the tumour on the right nerve was far larger than that on the left. And when we bear in mind the fact that otosclerotic changes in the bone are almost invariably bilateral, the probability is that an area of otosclerotic bone was present on the right side in a more advanced stage than that on the left and had caused ankylosis at the stapedio-vestibular articulation. Finally, in the other case of bilateral acusticus tumour described in this paper, similar areas of otosclerotic bone were present in both temporal bones in front of the oval window, and on one side ankylosis had occurred. Taking all these facts into consideration it appears to the writer that the negative Rinne was a real and not a pseudo-negative Rinne as was suggested by two speakers when the clinical aspects of the case were described by Mr. Ormerod at the meeting of this Section on December 2, 1932.

In conclusion some remarks may be made in regard to certain conditions found in the two cases described in this paper and in the case recorded by the present writer at the meeting of this Section in March, 1932. These three cases are the only ones in which the writer has had the opportunity of making pathological examinations of acusticus tumour. It is significant that all three occurred in the course of multiple neurofibromatosis (von Recklinghausen's disease), and in all three cases the tumour on the acoustic nerve was bilateral. In all three cases the ganglion spirale was affected, and it is clear that this is a fairly early change, because in Case II in this paper the tumour was very small and had hardly begun to produce clinical evidence of any disturbance of hearing. It is interesting also to note that, in spite of the very advanced degenerative changes in the ganglion spirale, in two of the cases the organ of Corti was apparently quite normal, and in the third case was only affected in the lowest whorl (*Proceedings*, 1932, xxv, 1273 (Sect. Otol., 85)).

But perhaps the most remarkable feature is the occurrence of areas of typical otosclerotic bone in all three cases. In two of the cases these areas were found in the situation in which they are almost always present in ordinary cases of otosclerosis, that is in front of the oval window. In the third case the otosclerotic bone was present in the canal of the cochlea in its apical whorl, a most unusual situation. The question therefore arises as to what these facts may signify. It is of course within the bounds of possibility that there is no relationship between the occurrence of the acusticus tumours and that of the otosclerotic bone. In other words, that all three patients had acusticus tumours and happened also by pure coincidence to develop otosclerosis. But it is in the highest degree improbable that such is a correct interpretation of the facts. There was no deafness in any of the cases until after the tumours had manifested their presence by disturbances of equilibration or delayed vestibular reactions. The otosclerosis, therefore, must have come into existence after the tumours on the acoustic nerves had developed. In one case the patient was only fourteen years old, and although otosclerosis certainly does sometimes occur as early in life as this, it is distinctly uncommon. On general grounds, of course, it is exceedingly improbable that, out of the only three cases of acusticus tumour that the writer has had the opportunity of examining after death, all three should have areas of otosclerotic bone without there being some relationship

of cause and effect. But I think it is justifiable to go further than that and to suggest what that relationship probably is. In a paper published in 1932,[1] the writer put forward the view that otosclerosis was the result of a defect in the reflex arc upon which depends the nutrition of the organ of hearing, and that the changes in the bone and in the cochlear nerve are two of the effects which may occur when that reflex fails. The three cases referred to in this paper lend further support to that view of otosclerosis. The slowly growing tumours on the acoustic nerves must interfere in some way with the nerve-fibres involved in the reflex arc. This would account for the changes in bone which present all the features of those found in typical otosclerosis.

It is interesting to observe that in Case I both the stapedius and tensor tympani muscles were quite healthy, in spite of the fact that the patient was completely deaf and the normal stimulus which excites contraction was therefore absent. This subject, however, is discussed more fully in the writer's "Atlas of Otology," vol. ii.[2]

Discussion.—Sir JAMES DUNDAS GRANT said that in the cases related there were two causes, either of which would suffice for a negative Rinne; it might be present even in unilateral deafness. It was a surprise to him to learn that otosclerosis was present, and what Dr. Gray had said helped to an understanding of the genesis of otosclerosis. He, Sir James, understood that the spot between the cochlea and the anterior limb of the stapes was—in some animals—the site of a depression, and was probably a weak spot. It was remarkable that in these cases of otosclerosis more frequent mention was not made of the galvanic reaction, as that was important.

Mr. F. C. ORMEROD said that in his own case he had been surprised to find a negative Rinne at the time of the examination, and he was greatly interested to hear Dr. Gray suggest that this was due to otosclerosis. Having in mind Dr. Gray's demonstration—fourteen months ago—of auditory nerves which he had removed from four otosclerotic patients, and the demonstration now given, he (the speaker) was impressed by the theory of the trophic cause of otosclerosis. He hoped that any members who encountered cases of acusticus tumour would send them to Dr. Gray.

Mr. SYDNEY SCOTT said that when Sir James Dundas-Grant and himself had discussed the case referred to they certainly thought there was perhaps a pseudo-negative Rinne. It might be a coincidence that otosclerosis was associated with the auditory nerve tumour.

Dr. Gray had shown a growth invading the cochlea. Twenty years ago he (the speaker) had shown sections of the labyrinth from a case of auditory nerve tumour, demonstrating the growth in the cochlea. It was quite possible that an otosclerotic condition had been overlooked in that case.

Mr. W. STEWART said that in many of these cases there was no obvious facial paralysis, but one sign which was pathognomonic of auditory nerve tumour was a sluggish reaction of the lids on the affected side, and they did not close so perfectly as on the unaffected side. Often that was the only sign.

Dr. T. B. JOBSON asked as to operation in these cases. There seemed to be no limit to the extension of these tumours, and there was, apparently, no possibility of eradication by a single operation.

The PRESIDENT said that in Mr. Ormerod's case the tests of the left ear had arrested his (the speaker's) attention, and he did not clearly follow the explanation which Dr. Gray gave. He himself thought there was a pseudo-Rinne, and it was of great interest to learn that an otosclerotic change was present.

Dr. GRAY (in reply) said that with regard to the depression a little outside the joint of the oval window, referred to by Sir James Dundas-Grant as being present in some animals, it might be that there was a break across there of phylogenetic origin, but in ordinary otosclerosis one always found ankylosis beginning at the joint. It was not a case of interference with the vascular supply.

1 *Proceedings*, xxv, 1286 (Sect. Otol., 98); *Journ. Laryng. and Otol.*, xlvii, 589.
2 Gray, "Atlas of Otology," vol. II, Glasgow, 1933.

He thought the reaction might be a pseudo-negative Rinne, but the probability was rather that it was due to ankylosis of the right stapes. Mr. Ormerod said it was a case of nerve deafness so far as the other signs and symptoms indicated.

In reply to Mr. Scott, concerning serial sections, it was very important to have a series, because in Mr. Ormerod's case the focus was minute, and might have been missed otherwise.

With regard to Mr. Jobson's suggestion concerning operation: for five years, he (the speaker) had given up operative work altogether. But the tumours were usually free from adhesions and might be easily removed in that respect. The real risk, however, was from hæmorrhage, and now that there was a special method of overcoming that by diathermy, removal could be attempted with a reasonable hope of success.

Section of Laryngology.

President—MUSGRAVE WOODMAN, M.S.

[*May 5*, 1933.]

Lupus of Palate, Pharynx and Larynx. (Further Report of Case previously Shown.)—J. F. O'MALLEY.

Male, aged 42. When shown (May 2, 1932[1]) there was extensive superficial ulceration of palate, fauces, pharynx, epiglottis, arytenoids and larynx, with marked loss of voice.

Now much improved, following ultra-violet irradiation by Dr. Beaumont at the Sunlight Clinic at Camden Road.

Discussion.—Dr. WILLIAM BEAUMONT showed a film demonstrating the actual treatment given.

He said that this was the first case of lupus of the larynx which he had seen, as he was not a laryngologist, and he had found it necessary to evolve a special technique. He had therefore designed a silvered quartz applicator for use with a new form of water-cooled mercury vapour arc lamp. With this it was possible to get the short ultra-violet rays in close contact with the lesion. The treatment given in this case was for three minutes three times a week for the first two months, then twice a week, and eventually once a week. In addition prolonged general body irradiation was given three times a week. This was suitable for other forms of tuberculous conditions of the larynx.

The lamp mentioned in the current number of *Journal of Laryngology and Otology*[2] consisted of a small mercury arc enclosed in a quartz casing which was introduced into the mouth. Because of the possibility of danger to the patient in his opinion any lamp of this design introduced an unnecessary risk. It was because of this that the technique shown in the film was evolved. The special quartz solid rod was designed so that the mercury vapour arc itself need not be introduced into the mouth. The radiation from the end of the quartz rod was approximately the same in wave length as from the arc itself, and was in the region of 1800 A.

Sir STCLAIR THOMSON said that tuberculosis was a kaleidoscopic and chameleon-like disease, varying so much in intensity that it would kill one patient in six weeks, while another would not succumb to it in 60 years, even if untreated. Any method which would shorten the duration of tuberculosis of the larynx was welcome, because a patient with only temporary or partial arrest of the lung disease could return to everyday life, and often could resume his ordinary occupation, and get well. On the other hand, a person who had the disease in the larynx, and whose return to everyday life meant resuming the use of the voice, ran a great risk; the larynx was not likely to recover, and if it did not, the lung condition was pulled down afterwards. The method now described was certainly worthy of a trial, especially as it did not seem to be such an ordeal as might have been thought; he gathered that it was a treatment of only three minutes' duration, given three times a week. Its effects would have to be controlled in a large number of cases. At Midhurst sanatorium years ago tuberculin treatment had been taken up, but with a negative result, and the Patterson method of partially graded exercises had been tried, also with negative results. The recent method of treatment by artificial sunlight according to Strandberg and others, had been tried, but without effect. He (the speaker) had been saying for thirty years that cases of lupus would recover under any treatment or no treatment. He had seen such cases treated and a cure attributed either to the galvano-cautery or to the Strandberg method; then they had relapsed,

[1] *Proceedings*, 1932, xxv, 1510 (Sect. Laryn., 48).

[2] 1933, xlviii, 326. "A note on tuberculosis of the larynx and light treatment," by A. J. Cemach.

and after the relapse they had recovered in the absence of any treatment at all. He did not, however, say this in condemnation of the method now described.

The present case gave a favourable impression, and he did not think that such a case could have done so well in so short a time under any other form of treatment.

J. F. O'MALLEY said that the change in the patient's condition since shortly after he had shown him at the meeting last year was remarkable. Mr. Barwell had then recommended arsenical treatment, and this was tried for some time, but without effect. After two months' treatment by Dr. Beaumont the patient had presented himself looking remarkably well.

Intranasal Radical Ethmoidectomy. A Series of Cases showing End-results.—L. GRAHAM BROWN.

(I) Female, aged 39. First seen June 10, 1932, complaining of frequent colds, attacks of nasal obstruction, discharge and sneezing since childhood. Also deafness in recent years. Adenoids removed at age of 14; cauterizations to turbinates in 1917 and 1925. Polypi present. Skiagrams showed dull ethmoids and hyperplasia of left antral mucosa. November 26, 1932: Bilateral ethmoidectomy and left Caldwell-Luc. Present condition: Cured of nasal symptoms and hearing much improved.

(II) Male, aged 36. First seen June 4, 1930, complaining of attacks of frontal headache, nasal obstruction and discharge. He has had mastoid operation on left ear for lateral sinus thrombosis. Polypi present in both middle turbinate regions. July 2, 1930: Bilateral ethmoidectomy. Present condition: Satisfactory; some crusting at first, but now nose remains clean and comfortable

(III) Male, aged 40. Seen May 1, 1931, with left frontal and left antral suppuration. May 6, 1931: Left radical ethmoidectomy and left intranasal antrostomy. Patient returned May 29, 1931, with swelling at inner canthus of left eye. Mucocele present. June 3, 1931: Left external frontal sinus operation. Present condition: Cure of symptoms and nose healthy.

(IV) Male, aged 32. Seen February 23, 1933, complaining of nasal obstruction and loss of sense of smell. Removal of nasal polypi seven years ago. Patient has attacks of hay fever every year. Both nasal fossæ completely blocked with polypi. March 1, 1933: Bilateral ethmoidectomy. Present condition: Nose comfortable and patient has regained his sense of smell.

Discussion.—HERBERT TILLEY said that this was a series of excellent results. There was an impression abroad that radical interference with chronic ethmoiditis was fraught with considerable danger, and that it was an unsatisfactory operation for curing the trouble. In the cases shown the presence of a little mucus was of no moment. These patients had lost their headache, and he would be a captious critic who would deny that the results were other than excellent. He asked whether, after removing the middle turbinals, Mr. Graham Brown had employed the Portmann curette for exenterating the "lateral mass" of cells, because it was an excellent instrument for this purpose, and permitted one to remove them with little risk to surrounding structures.

L. GRAHAM BROWN (in reply) said that in the opinion of some rhinologists the operation of radical ethmoidectomy was very dangerous, and they considered that in some cases of polypi, with infection, it was sufficient to remove the growths locally, and that further surgical interference would give a bad result. That, however, was not his experience. His method was to have the patient anæsthetized and reclining on the table in a semi-sitting posture, to cocainize, and then remove piecemeal the whole of the ethmoid cell area. The latter was the key position to all the sinuses, and by operating on this area one could very often obtain good results where other sinuses were complicated.

He had never used the curette mentioned by Mr. Tilley; he had used the Sluder knife, but his objection to this and all curetting methods was that they did not allow of the necessary gentleness. The liability to meningitis should not be forgotten, though he had never yet had a case in over 100 patients operated upon by his method.

Endothelioma of Left Maxillary Sinus, Nasopharynx and Cervical Glands. Disappearance of all Foci after X-ray Treatment.—J. F. O'MALLEY.

Male, aged 64. First seen at Royal Ear Hospital, April 20, 1932, on account of swelling on left side of neck (nine weeks) and sore throat (seven or eight weeks). Occasional difficulty in swallowing liquids and solids.

On examination.—A tumour was palpable just above and behind the palate on the left side. Glands palpable, discrete, mobile both sides of neck. Largest mass under left sternomastoid muscle. Case referred, as one of doubtful carcinoma, to Mr. Julian Taylor, who had some glands removed under local anæsthesia. These were reported to be endothelioma.

Patient was then submitted to the following X-ray treatment: Kilovoltage 190 kv. continuous current; filter, 1 mm. copper, 1 mm. aluminium; focus skin distance, 40 cm.

Dosage.—(1) *To enlarged cervical glands*: 200 r to each side of neck on alternate days for six days: Total of 600 r on each side of neck. Followed by 500 r twice to right side of neck at an interval of two and four months respectively. Area irradiated 20 by 25 cm.

(2) *To enlarged glands in both axillæ*: 250 r-500 r repeated five times at varying intervals for five months. Area irradiated 6 by 8 cm.

(3) *To left antrum* (after January 8, 1933): 1,000 r to left antrum spread over five days, followed by 600 r spread over three days after an interval of two months. Area irradiated 6 by 8 cm.

January 8, 1933.—Returned again with history of nasal discharge for six months and gradual obstruction of left nasal passage, and an X-ray report of "marked opacity of left antrum."

No sign of tumour in nasopharynx or enlargement of glands. Left side of nose occluded, mucous membrane swollen and pale. Much pus present anteriorly and posteriorly. On transillumination: Left side very dark; right clear. On puncture of left antrum: Soft mass felt between end of cannula and inner wall of antrum.

No fluid could be syringed into the nose or withdrawn by aspiration. Some blood escaped from puncture wound.

Sent for X-ray treatment, as this seemed to be effective in nasopharynx and glands (see above).

January 24, 1933.—Can now breathe through left nostril. Discharge gone. Transillumination: Left side less dark.

February 1, 1933.—Lipiodol (5 c.c.) injected into both antra (see Pfahler, *American Journal of Roentgenology*, 1932, xxvii, 352). Oil retained in left antrum until operation.

February 20, 1933.—Caldwell-Luc operation: (*a*) To establish diagnosis by removing any portion of growth remaining. A few small pieces found; reported on as endothelioma. (*b*) To ventilate sinus and connect with airway of nose.

Carcinoma of Œsophagus in a Male aged 45 years, treated with Radon Seeds. Patient free from symptoms two years later.—LIONEL COLLEDGE.

History.—Admitted to St. George's Hospital on April 16, 1931, complaining of difficulty in swallowing for four months and inability to swallow solid food for two months. Slight pain in chest. Had lost more than 2 st. in the previous four months. Voice had been husky for a similar period; cough not marked.

Examination and treatment.—The Wassermann reaction was negative. Report on barium skiagram: "A definite obstruction of the œsophagus in its lower third. The œsophagus above the site of obstruction is dilated and below the obstruction the lumen is narrowed and irregular. The appearances are those of an

organic obstruction, probably malignant." The right cord was fixed. The patient was œsophagoscoped under local anæsthesia on May 2, 1931, when an ulcerating growth with a raised edge was found at about the level of the fourth dorsal vertebra. Five radon seeds were inserted into the growth. On May 20 five more seeds were inserted and this procedure was again repeated on June 10.

Progress.—The patient was much improved, and by the end of June, 1931, was able to swallow solid food, and had gained 10 lb. in weight. In March, 1932, patient was free from symptoms, and on œsophagoscopy no evidence of neoplasm was seen. In March, 1933, patient remains free from symptoms, and has gained a further 8 lb. in weight. The right cord remains fixed.

LIONEL COLLEDGE, in reply to a question by the President, said that he did not remove a piece, because by so doing he thought that one took away the slender chance of a cure. He did not doubt that the disease was malignant. He thought little harm was done by removing a piece from the larynx, where the lymphatic drainage was not so free. In the first case of the kind which he had treated, the disease disappeared entirely, and the patient remained clinically well for ten months, and then returned with a perforation into the bronchus. He felt that had he treated that patient for a longer period, the result might have been better. Therefore in the present case, and in some subsequent ones, he put in three sets of seeds, at intervals of a week, and this case showed an encouraging result, and indicated that one might aim at something more than palliative treatment.

Carcinoma of Pharynx treated by Radium and deep X-ray Therapy.—E. A. PETERS.

Female, aged 63, September 4, 1930, admitted on account of large carcinoma of posterior wall of pharynx. Ten needles, each containing 1 mgm. radium, screened with 0·5 mm. platinum, were inserted behind the growth for a week. November 18, 1930.—No growth visible, but small gland present in neck; radium collar applied for one week. February 25, 1932.—Circular ulcer on posterior pharyngeal wall; Wassermann negative; eight 1 mgm. radium needles inserted for a week. October 21, 1932.—Pain and dysphagia. Ulcerating growth on posterior wall; upper cervical spine rigid and painful; erosion of cervical vertebræ. Deep X-ray therapy carried out by Dr. R. W. A. Salmond and Dr. E. L. G. Hilton.

There is now a low depression on the posterior wall of the pharynx, with mucoid exudation; patient moves the neck quite freely. No pain; no enlarged cervical glands; no disease apparent.

Discussion.—The PRESIDENT said that if the erosion of the cervical vertebræ had been caused by the radium, why had it healed when deep X-ray therapy was carried out? If it was not due to the radium, to what was it due?

E. A. PETERS (in reply) said that there was no actual necrosis of bone, so he presumed that the bone absorption was due to extension of the growth. There were a few glands in the neck. The case showed how, under certain conditions, deep X-ray therapy was effective, for a time at any rate, when the application of radium had failed.

A. D. SHARP said these notes on the action of radium or malignant disease of the œsophagus were encouraging, as it was generally agreed that radium was less successful when ulceration occurred with malignant disease.

A year ago he had a case in which the whole of the hypopharynx was filled with malignant growth, which the pathologist reported to be epithelioma with keratinization. Ten radon seeds were inserted, and in the course of six weeks there was nothing to be seen of the tumour. He had been unable to ascertain where the growth originated. There was difficulty in swallowing, so that even fluids could only be got down with trouble. During the six weeks there was much distress on account of the presence of mucus and sloughing. The growth was found to have arisen from the aryteno-epiglottic fold, and there was now to be seen a white band, apparently fibrous. Three months later a radium collar was applied.

Choanal Polyp which caused Death by Respiratory Obstruction.—T. B. JOBSON.

Male, aged 39, had suffered from nasal obstruction and discharge for many years. Polypi removed in 1918. Patient was "gassed" in the European War, and suffered from bronchitis and emphysema. Left side of nose blocked with polypi.

April 4, 1933, operation.—Atropine, gr. 1/75, nembutal, gr. iii; morphia, 1/6 gr. at 10.15 a.m. Operation 10.45 a.m.: bilateral Sluder ethmoidectomy, anæsthetic induction was normal. A post-nasal plug was inserted by the house surgeon. The operation proceeded normally. Large masses of polypi were removed from both sides, more on the left. Post-nasal plug was removed, and patient was returned to the ward. He had morphia gr. 1/6 at 1.40 p.m. His colour was a little blue, but this was attributed to the emphysema. Later his respiration became worse, and he died at 3.45 p.m.

At autopsy a large myxomatous polyp was found in the hypopharynx, partially impacted at the opening of the larynx. The polyp was pyriform, hanging down by a stalk from the left posterior nares.

This tumour must have been in the man's pharynx for many weeks, yet he made no complaint or reference to it either before or during his stay in hospital.

Lingual Goitre.—T. B. JOBSON.

Patient, a girl aged 16, had been talking indistinctly for about a year and was thought to have "adenoids." Examination showed a purple tumour about the size of a walnut at the back of the tongue, with several large veins on the surface.

The tumour was visible when the girl protruded her tongue, and then filled up the oro-pharynx, obscuring the edge of the soft palate and uvula. The foramen cæcum could not be identified with certainty.

March 5, 1933.—Admitted in a collapsed condition due to hæmorrhage; red cell-count, 1,860,000; 400 c.c. blood transfused (Group IV).

March 17, 1933.—Second transfusion followed by anaphylaxis.

March 19, 1933.—Red cell-count, 4,880,000.

April 14, 1933.—Cauterization by diathermy of the superficial vessels on the tumour, under local anæsthesia, through a laryngoscope.

Postscript (July 22, 1933).—Condition to date unchanged. No further hæmorrhage.—[T.B.J.]

Congenital Shortening of Œsophagus.—A. J. WRIGHT.

Male, aged 7 years. Difficulty in swallowing both solids and liquids, with frequent regurgitation, since infancy. Undersized and poorly nourished. Skiagram, July 1927, showed a tight stricture in the lower third of the œsophagus. The presence of the gastric pouch in the thorax was not recognized until nearly two years later, when a skiagram was taken with the patient inverted. (See *Proceedings*, 1929, xxii, 1263; Sect. Laryn., 35).

During the period from 1927 until 1930 the stricture was dilated on several occasions with Jackson's bougies through the œsophagoscope. This dilatation became progressively more difficult until November, 1930, when no bougie could be passed. Further treatment was refused until July, 1931, when a gastrostomy was performed and continuous dilatation carried out with rubber tubes on an endless string. This was maintained for two months and was followed by the intermittent passage of bougies. By July, 1932, the stricture had again become impassable. In November, 1932, an attempt at forcible dilatation with a metal bougie as a preliminary to application of diathermy led to perforation into the pleura with fatal result.

Pathological report on specimen (Dr. A. L. Taylor). "Slightly below the bifurcation of the trachea and 2½ in. above the diaphragm, the œsophagus shows a stricture half an

inch in length, through which a probe could be passed only with difficulty. At this site the œsophageal wall is thickened, fibrosed and adherent. Immediately above the stricture the œsophagus is dilated and hypertrophied, with corresponding thickening of the mucous membrane, which is thrown into prominent whitish folds. Below the stricture a pouch communicates with the stomach proper through an aperture one inch in width, widely separating the crura of the diaphragm. The mucous membrane lining the pouch is continuous with that of the stomach below, and closely resembles it to the naked eye; microscopically it is found to contain typical gastric glands throughout. No trace of œsophageal epithelium was discovered in several sections examined. Perforation has occurred on the right side immediately above the stricture, and the lung on this side is completely collapsed."

Congenital Tracheo-œsophageal Fistula in an Infant.—A. J. WRIGHT.

Specimen from a male infant six days old. The child swallowed normally, but ejected every feed from birth, and became cyanosed while doing so. Skiagrams showed a dilated œsophagus, which ended in a blind sac just above the bifurcation of the trachea, and a stomach widely distended with air. A gastrostomy was performed and feeds introduced by tube, but vomiting continued, again with respiratory distress. Death occurred the following day.

At autopsy the upper half of the œsophagus was found to be hypertrophied and dilated, ending blindly above the lower end of the trachea. Its lower half communicates with the trachea near the bifurcation, and forms a continuous tube leading to the pharynx. Microscopically the epithelium of both parts of the œsophagus is of normal squamous type, and the cardio-œsophageal junction is normally situated.

This type of malformation is apparently due to adhesion between the pulmonary bud and the primitive œsophagus, with disappearance of the intervening wall. It is difficult to explain the great hypertrophy of the œsophagus in its upper part unless one presumes that swallowing movements take place *in utero*.

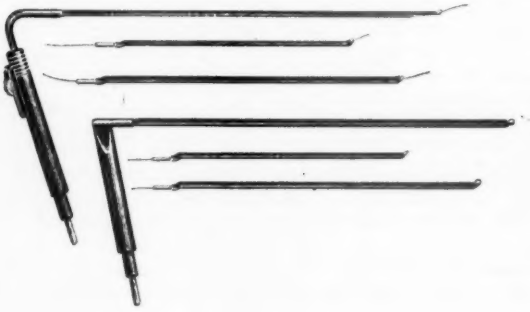
In this case there was also gross deformity of the left arm and hand, due to bony mal-development.

Demonstration of Instruments.—H. G. BEDFORD RUSSELL.

(1) An adjustable instrument for synchronous transillumination of the frontal sinuses.

(2) Electrodes and handle for diathermy in the larynx and trachea.

The cautery comprises a fine wire electrode, accurately extrusible from an insulating holder, controlled by means of a sliding button under the thumb. The instrument has stood up to routine work at St. Bartholomew's Hospital for upwards of two years.



Section of Orthopædics.

President—G. R. GIRDLESTONE, F.R.C.S.

[*April* 4, 1933.]

Four Cases of High Fracture of the Neck of the Femur, treated by the use of a Smith-Petersen Pin.—R. BROOMHEAD, F.R.C.S.

These four cases are from a series of ten in which I have inserted a Smith-Petersen pin for a high fracture of the neck of the femur (figs. 1 and 2, p. 62). One of the ten patients was operated upon two years after the injury and was not improved. Two were operated on four and five weeks afterwards respectively; one of these has been shown to-night. The skiagram in this case, taken six months after the operation, shows bony union at the site of fracture (figs. 3 and 4).

The age of the patients varied from 56 to 82.

The type of anæsthesia has been open ether where the patient has been fit, and a combination of spinal, local, and gas-and-oxygen, where there have been doubts as to the patient's condition. I have been most impressed by the absence of shock following the operation. The patients and the wound have been kept warm, there has been a minimum of bleeding, and no unnecessary leverage; none of the patients left the table with an increase in the pulse-rate of more than 10. Some of them were given a gum-saline infusion before they left the theatre as a precautionary measure.

Description of operation.—An incision made along the anterior third of the crest of the ilium is prolonged down the upper-third of the thigh along the line of the sartorius; it is then carried backwards for three or four inches so that it is as a whole more or less semicircular. Tetra-cloths are then applied. The upper part of the wound is deepened and an incision is made through the deep fascia, gluteus maximus, and tensor fascia femoris half an inch below their origins and down to the ilium. The muscles are then stripped subperiosteally from the ilium with an osteotome. It is important to do this part of the operation subperiosteally as thereby much bleeding is avoided. The foramina that bleed in the ilium are compressed in the same way as those that bleed in the skull. The tensor fascia femoris and sartorius are then separated and the branches of the external circumflex artery exposed and divided between ligatures; the sartorius and vastus externus are pushed to the inner side, the outer flap is freed in the whole length of the incision until the external surface of the great trochanter is exposed. There is a band of fascia lata at the lower end of the incision, which must be divided before the flap is really free. The place that always bleeds is just below and to the inner side of the acetabular rim, where there are one or two troublesome vessels.

When the flap has been turned out, the great trochanter and the capsule of the joint, together with the acetabulum, are exposed and can be seen quite clearly. The capsule of the joint is opened by an incision parallel to the rim of the acetabulum, and from the inner part of this incision a second one is made in the long axis of the neck of the femur. The triangular flap thus marked out is retracted and the site of the fracture is exposed.

When the triangular flap has been pulled on one side a Smith-Petersen hip retractor is inserted into the joint, to act as a stay for the head of the femur and as a retractor for the tissues on the inner side of the incision; the operation cannot be well done without this retractor. The femur is then abducted and fully rotated internally to bring the fragments into position. Any additional reduction can be obtained by putting in a lever between the fragments. A guide is then driven through the cortex of the great trochanter. This guide is used to make sure that the aim of the pin is correct and also to prevent the cutting edge of the pin becoming blunted by driving it through the cortex of the great trochanter. The pin is driven through the hole made by the guide, across the fracture, and into the head of the femur. The length of the

FIG 1.—Skiagram showing the kind of fracture treated in each case.

FIG. 2.—Same case as in fig. 1, after insertion of pin. The patient (aged 56) was walking in the fourth week after the operation.

FIG. 3.—Skiagram of a one-month-old fracture immediately after insertion of pin.

FIG. 4.—Same case as in fig. 3, four months later, showing bony union

pin required can be ascertained by measuring with a machinist's calliper from the head of the femur to the external surface of the great trochanter. If the pin has been inserted satisfactorily, the head and shaft of the femur move as one when the thigh is rotated. The capsule is next sutured with No. 4 catgut, the muscular flap is replaced and sutured, and the incision is closed.

The pin which I use is a modification of the one designed by Smith-Petersen; his pin has a smooth head but mine is flanged, because when the aim has been incorrect it is necessary to withdraw the pin, a procedure which is made easy by the use of the improved pin and the special extractor which fits it.

After-treatment.—Our patients have been kept in bed for about four weeks; the stitches have been taken out at the end of three weeks and the patients have begun walking in the fourth or fifth week from the time of operation.

As a rule, the only form of splint I have used has been the ordinary talipes or club-foot splint, with a transverse bar at the back to prevent the thigh becoming everted.

Patients walk at first with two sticks, but are soon able to discard one of them. They should be able to walk without a stick inside the house in three months and, except in bad weather, outdoors in six months. In three months they should have hip and knee flexion to 90° and although the hip flexion will not increase materially beyond a right-angle, in some cases almost full range of movement is obtained at the knee.

Smith-Petersen advises that the pin should be removed in about a year. I have not yet done this but where a skiagram shows good bony union, removal of the pin seems to be advisable.

Abnormal Internal Semilunar Cartilage of the Knee. J. M. TURNER, F.R.C.S.

R. S., male, aged 32.

History.—On January 26, 1933, slipped down some steps and injured his right knee, twisting it outwards. The knee swelled up at once and became very painful. True locking in flexion occurred and since the accident the patient has been unable fully to extend the knee.

Examination. 3.2.33.—Right knee-joint distended. Marked tenderness over the anterior end of the internal semilunar cartilage. Extension limited by 10°, flexion by 15°. Extreme of each movement painful. Internal rotation nil. External rotation limited.

Operation. 14.3.33.—Much glairy fluid present. The anterior portion of the internal semilunar cartilage was quite free. The sole attachment of the cartilage was to the internal lateral ligament—for a distance of three-quarters of an inch. After dividing this attachment, the cartilage was found to be in the form of a complete ring, the lateral half occupying the intercondyloid fossa.

There was no suggestion of an anterior or posterior horn and no evidence of any former attachment to the upper surface of the tibia. This excludes the possibility of simulation by a complete bucket-handled tear of the cartilage.

My thanks are due to Mr. R. Y. Paton for permission to show this specimen.

Case of Progressive Myositis (Fibrositis) Ossificans.—H. JACKSON BURROWS, F.R.C.S. (by permission of R. C. ELMSLIE, O.B.E., M.S.).

Patient, male, aged 16, complaining of stiffness affecting chiefly the back and jaw.

History.—No abnormality was noticed at the time of birth. At the age of 4 months, swellings became evident in various parts of the scalp, but disappeared completely.

At the age of 2 years the front of the neck became swollen. Aspiration seems to have yielded blood only. The swelling appeared to move to the back of the neck,

and was followed by similar swellings in various parts of the whole dorsal region during the next five years. They were firm, not painful or tender, and frequently gave the impression of gradually moving from place to place. Their onset often appeared to be determined by injury. Sometimes they disappeared completely; at others they left a residual induration and stiffness, so that by the age of 7 the patient's back was almost completely rigid and the movements of the arms on the

FIG. 1.

trunk greatly limited. At about this time a piece of bone was removed from the right latissimus dorsi, but no improvement followed.

Since the age of 7, though the characteristic swellings have appeared from time to time, there has been but slight progress of the disease except that there has been increasing limitation of movement of the mandible since the age of 11 years.

Family history.—No history of similar trouble, or of microdactyly, in father, mother or ten brothers and sisters (all older than the patient).

Physical and radiological (Dr. Simon) examinations.—Weight 4 st. 5½ lb. Height 4 ft. 7½ in.

Hypoplasia of genital organs, with absence of pubic and axillary hair. Voice moderately deep.

Spine rigid, except for slight movement in cervical and upper dorsal regions; scapulæ fixed; shoulder movements limited; chest expansion 1 in. Bony plaques and bars over posterior aspect of cervical, dorsal and lumbar regions (fig. 1);

FIG. 2.

particularly marked in latissimus dorsi (fig. 2) and trapezius. Left masseter similarly affected. Exostoses: inner end of left clavicle (sternomastoid), lower end of right radius and ulna (pronator quadratus), each lesser trochanter, above adductor tubercle of each femur, upper part of each tibia (soleus), plantar fascia attachment of each os calcis.

Microdactyly of great toes and thumbs. Shortened first metatarsal with rudimentary proximal phalanx fused with distal end. Shortened first metacarpal having both proximal and distal epiphyses; wedge-shaped epiphysis to proximal phalanx; evidence of proximal epiphysis to second metacarpal.

Pituitary fossa (lateral view) 8 mm. by 7 mm.

PATHOLOGICAL INVESTIGATIONS (Dr. ARCHER and Mr. VARTAN).

Blood Wassermann	Negative.
Blood phosphorus (inorganic) ...	4·5 mg. per 100 c.c. plasma.
Blood calcium	10·2 mg. per 100 c.c. serum.
Blood phosphatase	0·241 units per 100 c.c. plasma.
Calcium and phosphorus metabolism	(In process of investigation by Mr. Hermon Taylor).
Alkali reserve	65·2 c.c. CO_2 at N.T.P. per 100 c.c. plasma.
Bleeding time	1 min. 30 sec.
Clotting time	2 min. 25 sec.
Blood-platelets	200,000 per c.c.

Comments.—Some 150 cases have been reported. The male sex is the one more commonly affected. Lesions (other than the microdactyly) are rarely present at birth, but usually commence before the 5th year. The history of the appearance of firm swellings which tend to be followed by ossification and consequent limitation of movement is typical, as also is the frequent association with trauma and the tendency for consecutive affection of adjacent parts, so that the swellings appear to move from place to place. While localized pain and tenderness may be pronounced, they are sometimes absent, as in the present case. Usually but not invariably hereditary influence is not apparent. The distribution of the new bone is typical; it is known to spread largely, but not exclusively, from the bony attachments of the muscles, affecting tendons, aponeuroses and intermuscular tissue rather than the muscle-fibres themselves. This accounts for the exostoses, some of which resemble closely those occurring in other conditions, e.g.—the exostosis of congenital sternomastoid torticollis, rider's bone, and calcaneal spur. It appears that ossification is preceded by hæmorrhagic effusions and that the bone begins in the fibroblastic tissue which forms in the margins of these. From other evidence it seems probable that the bone in the present condition, in traumatic myositis ossificans and even in exostoses of infective or traumatic origin is metaplastic and not the product of vagrant osteoblasts; the contiguity to bone depends on the availability of calcium. Islands of cartilage are usually present with the bone. Experimental inoculation of tendinous insertions of this patient and of a normal person with normal blood and with the patient's blood were without obvious effect, but the quantity used (1 c.c.) for each inoculation was small.

Microdactyly is almost always present in this disease and almost invariably affects the great toe. There is shortness of the metatarsal, and often synostosis between the phalanges or, less commonly, between the proximal phalanx and the metatarsal, as in the present case. This tendency to fusion may account for the instances in which a phalanx has appeared to be absent, and almost certainly explains two cases in which a seemingly enlarged metatarsal has been associated with the apparent absence of the proximal phalanx. In about half the reported cases the thumb also is affected. The presence of two epiphyses in the first metacarpal and of traces of a basal epiphysis in the second occurs in persons otherwise normal.

Relative infantilism is exceptional, but has been noted in a few previous instances.

Blood and metabolism investigations have shown no gross abnormality in cases of this condition. I can find no record of the blood-phosphatase in previous cases.

The following cases were also shown :—

Facial Palsy.—G. R. GIRDLESTONE, F.R.C.S. (President).

Spondylolisthesis treated by the Insertion of a Bone-Graft into the Vertebral Bodies, the Bodies being approached via the Abdomen.—B. H. BURNS, F.R.C.S.

(1) Synovial Chondromatosis of the Knee-Joint. (2) Loose Body in the Ankle-Joint. (3) Adolescent Rickets.—R. W. BUTLER, F.R.C.S.

A Clicking Wrist.—A. ROCYN JONES, F.R.C.S.

Ununited Fracture of the Scaphoid in a Man aged 21; Bony Union after Prolonged Fixation in Plaster.—S. A. S. MALKIN, F.R.C.S.Ed.

Adolescent Rigid Kyphosis.—G. O. TIPPETT, F.R.C.S.

[*May* 2, 1933.]

Case of Severe Comminution of the Femur.—E. LAMING EVANS, C.B.E., F.R.C.S.

Severe comminution has most frequently been met as the result of impact of high-velocity projectiles with compact bone: such cases are necessarily compound.

The advent of the high-speed motor-cycle and the high-speed motor-car has created a new type of bone injury, namely severe comminution which is not necessarily compound, and which may be accompanied by bruising of the skin, with severe laceration of the underlying muscles.

A good example occurs when the right femur of the motor-cyclist, travelling at 75 miles an hour, comes in contact with a car travelling at a similar speed. Such impact may lead to the severest form of comminution, 2 or 3 inches of the femur being knocked out of the shaft and broken into twenty or more pieces. The force of impact will carry these fragments deep into the surrounding soft tissues, where they will remain firmly impacted, and where the firmness of impaction will prevent them falling into alignment when longitudinal traction is applied to the limb.

Such injuries are of common occurrence, but are more often observed in the mortuary than in the ward owing to concomitant injuries inflicted by such terrific impact.

The case shown illustrates this condition :—

R. A., aged 28. Crashed from motor-cycle on August 13, 1932. His injuries were :—

(1) Dislocation of the left shoulder with nerve involvement of the eighth cervical and first dorsal roots.

(2) Compound fracture of the right fibula with laceration of three-quarters of the fibres of the tendo Achillis: this wound was full of road débris.

(3) Severe comminution of the right femur in the middle third, with marked displacement of fragments, which numbered 20 to 30.

FIG. 2.—August 26, 1932. Lateral.

FIG. 1.—August 26, 1932. Antero-posterior, taken by portable with 40 lb. extension applied.

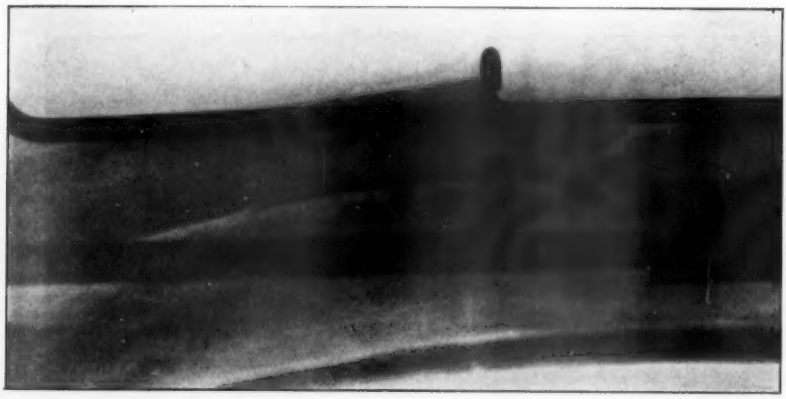


FIG. 4.—September 27, 1932. Lateral.

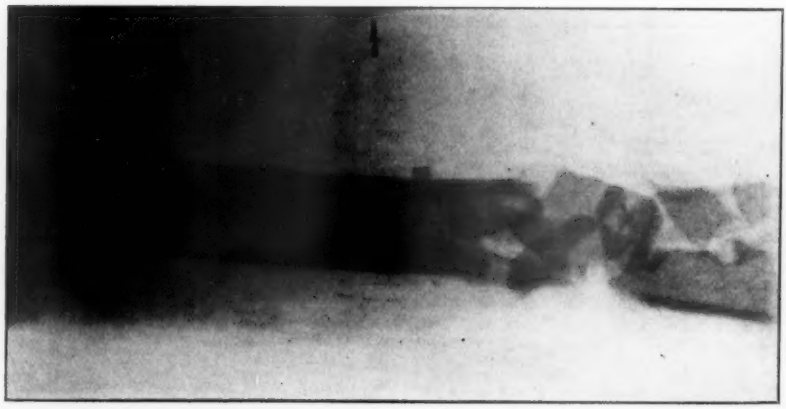


FIG. 3.—September 27, 1932. Antero-posterior. Taken four weeks after operation.

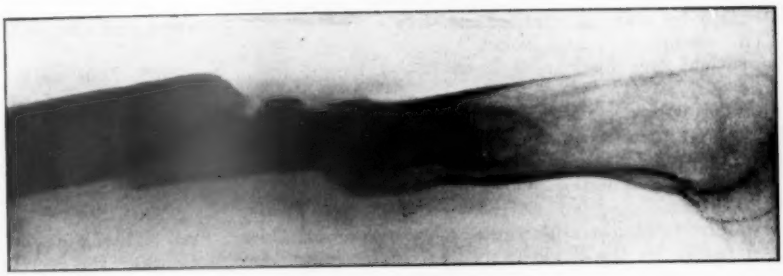


FIG. 6.—March 23, 1933. Lateral.

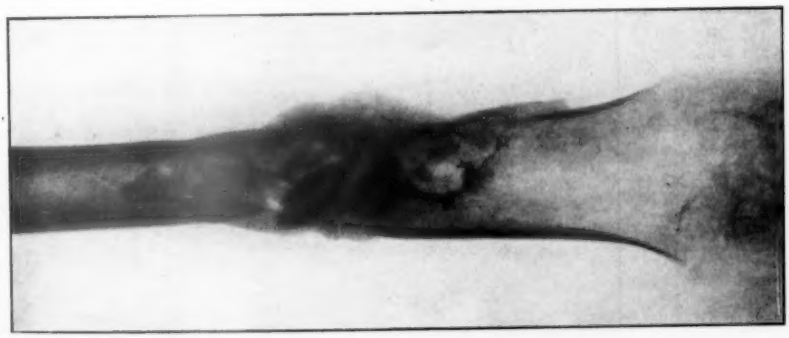


FIG. 5.—March 23, 1933. Antero-posterior, firm union. ½-inch lengthening.

The dislocation was reduced: the compound wound was excised and the tendo Achillis was sutured. Extension of 40 lb. was applied to the femur by a Kirschner wire through the tubercle of the tibia.

The excised wound healed without suppuration, but the fragments of the femur failed to align after eighteen days.

Operation (August 31, 1932).—The site of the fracture was approached by Henry's incision between the vastus externus and the rectus; the crureus was incised and the fragments were collected and arranged in rough apposition, after the rents in the crureus had been sutured with catgut.

Extension by manual traction was kept up during the operation and afterwards by a 40 lb. weight.

The patient was discharged from hospital on January 9, 1933, in a walking calliper.

Union is now firm: he walks without calliper and there is ¼ to ½ in. lengthening.

The main difficulty at operation was, owing to the severe laceration of the crureus, to reconstruct the round tubular structure of this muscle; some unsutured rents allowed some lateral displacement of the replaced bony fragments, as is shown in the skiagram.

The failure to obtain alignment by extension during the first eighteen days is explained partly by the firmness of the impaction of the fragments in the crureus and partly by muscle attachment to the fragments: in the latter case, the fragments had to be completely separated from all soft tissues before replacement was possible.

All the fragments were replaced, and many had no periosteal covering.

Two Cases of Tuberculous Osteomyelitis of Patella.—D. McCrae Aitken, F.R.C.S.

(1) E. N., a girl, aged 10.

History.—Said to have had pain in the left knee two years ago, called rheumatism. Since November, 1932, pain had been always present.

Fig. 1.—E. N. 18.1.33. Before operation.

FIG. 2.—E. N. 28.3.33. After operation.

FIG. 3.—E. L. 10.5.33.

18.1.33.—Seen at Shropshire Orthopædic Hospital, with painful swelling in left knee; no redness. Admitted immediately. Only about 30° movement without pain. Temperature 98°; pulse 120.

18.1.33.—Skiagram showed small cavity in upper pole of patella; joint surface apparently not broken (fig. 1, p. 72).

Tests.—Von Pirquet negative; intradermal positive.

Treated on Thomas's knee splint.

4.3.33.—Patella exposed and cavity gouged out. Material sent for examination. Pathological report: Histologically, tuberculous tissue.

28.3.33.—Skiagram shows apparent healing of bone by first intention (fig. 2, p. 73). Patient has been allowed up and is walking about under observation, with a back splint.

(2) E. L., female, aged 25.

History.—Treated at St. Mary's Hospital, Paddington, for sinus in lumbar region.

Admitted to Shropshire Orthopædic Hospital, March, 1931, on account of tuberculous disease of the spine.

Skiagrams showed destruction of parts of first and second lumbar vertebræ.

19.3.32.—Complained of swelling on outer side of right patella. Swelling seemed to be superficial and was aspirated. Pus sent to laboratory. No tubercle bacilli found and culture sterile. Guinea-pig test showed typical tubercle.

January, 1933.—Skiagram of knee shows condition of patella, in which bone was apparently being destroyed.

4.2.33.—Operation. Anterior plate of patella found loose and lying on cheesy pus. Whole loose anterior plate removed and cavity swabbed out, wound closed.

10.5.33—Fig. 3, p. 73, shows condition fourteen weeks after operation.

The following cases were also shown:—

Congenital Scoliosis.—G. R. GIRDLESTONE, F.R.C.S. (President).

Series of Skiagrams showing Reformation of the Head of the Femur.—S. A. S. MALKIN, F.R.C.S.Ed.

Bilateral Congenital Dislocation of the Head of the Radius.—E. A. LINDSAY, F.R.C.S.

Ununited Fracture of the Tibia and Fibula.—D. MCCRAE AITKEN, F.R.C.S.

Bilateral, Traumatic Central Dislocation of the Head of the Femur successfully reduced and treated by Skeletal Traction.—B. WHITCHURCH HOWELL, F.R.C.S.

Section of Therapeutics and Pharmacology.

President—E. P. POULTON, M.D.

[*March* 14, 1933.]

The Anti-Anæmic Principle in Stomach Tissue.

By JOHN F. WILKINSON, M.D.

AT the present time it appears to be fairly certain that the gastric juice of normal individuals contains not only hydrochloric acid and certain well-known enzymes, such as pepsin, but also an anti-anæmic factor which appears to be of an enzyme-like nature, since it is readily destroyed by heat and requires the addition of a substrate for its effective action, the necessary incubation being carried out *in vitro* or *in vivo* [1, 2, 6].

In pernicious anæmia, however, it has been repeatedly observed that the gastric secretory functions are deficient [3], so that hydrochloric acid and the anti-anæmic factor are not present.

The therapeutic developments of these observations have led to the use of animal stomachs in the treatment of pernicious anæmia. It is not necessary to consider this therapy here since it has already been referred to at previous meetings [4], but I may remind you that fresh uncooked pig's stomach is extraordinarily active in this respect, although it may require a certain amount of dietetic skill for its successful administration. On the other hand, the desiccated products are very convenient and satisfactory, and are much cheaper than any other method of treatment. An immediate consequence of the success of this stomach therapy was the appearance of about seventeen commercial preparations, the majority obviously without any clinical evidence in support of their value for the treatment of pernicious anæmia. As a result of our investigations upon the activities of these products, and certain suggestions that were made [5], many of them have been markedly improved, but there are still one or two of doubtful value, while the relative costs show enormous variations. [*A slide was shown illustrating the various active and inactive products with their relative costs.*] I wish to draw attention to the invariable association of hæmopoietic with peptic activity in these stomach preparations. As I will show later, we have had much difficulty in separating the hæmopoietic factor from pepsin.

It should be emphasized that desiccated stomach preparations are not *extracts* but are merely the fresh tissues from which as much water as possible has been removed by drying; therefore the so-called concentration cannot be more than about one-sixth to one-seventh, allowing for about 10% of fat.

Clinical testing.—Despite the extreme importance of testing all products used in treatment, it is not an easy or straightforward procedure to assess the value of these preparations—and also of the experimental products that I shall describe—for their abilities to produce remissions in pernicious anæmia. It is only possible, as yet, by direct clinical trial on patients suffering from this anæmia. Further, only a very small proportion of these cases can be used for such test purposes since so many have a marked tendency to commence spontaneous remissions. Thus, during the last eight weeks, of sixteen new cases of pernicious anæmia coming under my care, five were in spontaneous remission, while a further six were useless for experimental purposes. It is absolutely essential, therefore, that for a correct

evaluation of the preparation on trial, certain rigid criteria must obtain: (*a*) A typical case of pernicious anæmia in relapse (characteristic blood picture and achylia gastrica) without complications or abnormalities. (*b*) The case must be in hospital under observation to ensure correct administration of the treatment and the omission of other possible complicating therapy. (*c*) An erythrocyte count of preferably 1,000,000 to 1,750,000 per cubic millimetre. (*d*) A control period of seven to ten days, during which the reticulocytes should remain within normal limits and the red cell count and hæmoglobin percentages should not show any improvement. (*e*) If the product is hæmopoietically active, reticulocytosis should occur within a few days following the institution of treatment, and this should be followed by an increase in the red cell count and hæmoglobin percentage (Chart I).

If the product is inactive then no reticulocytosis occurs and the blood picture does not show any improvement. This case must then be controlled by the administration of a known active preparation of stomach when the normal response must occur (Chart I). If this does not take place the case is rejected as being unsuitable for testing purposes. In all cases the tests are repeated on at least two to three other cases.

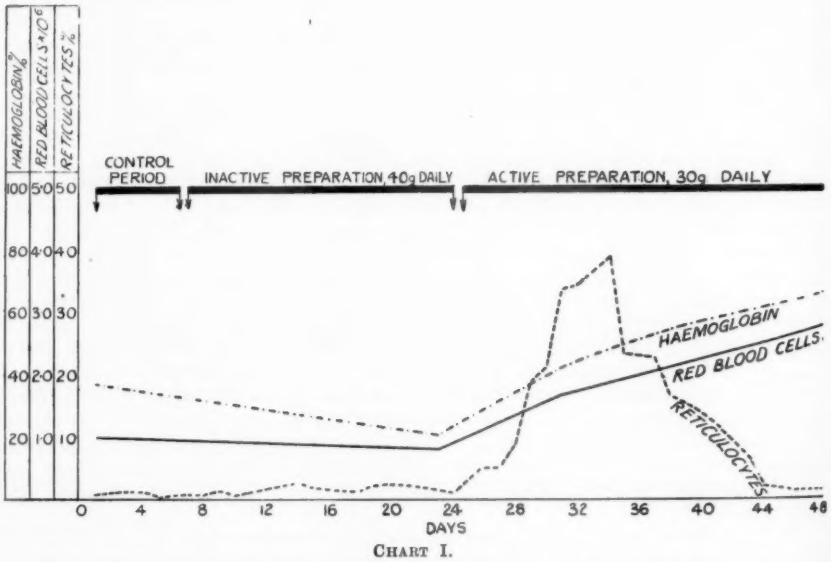


CHART I.

Typical responses following the use of inactive and active preparations of animal stomachs.

Chart I illustrates these points. It will be seen that during the control period the reticulocyte and red cell counts and the hæmoglobin percentages did not show any improvement. From the seventh to the twenty-fourth day an inactive preparation was administered without response. The subsequent administration of 30 grams daily of an active desiccated stomach, from the twenty-fourth day onwards, gave a typical reticulocyte crisis, with a maximum "peak" in this case on the tenth day, falling again to normal levels more slowly. Simultaneously the red cell count and hæmoglobin percentage showed rapid improvements.

This is the method we have employed in all our trials of stomach preparations and fractions, so that it will be appreciated that a large number of cases become

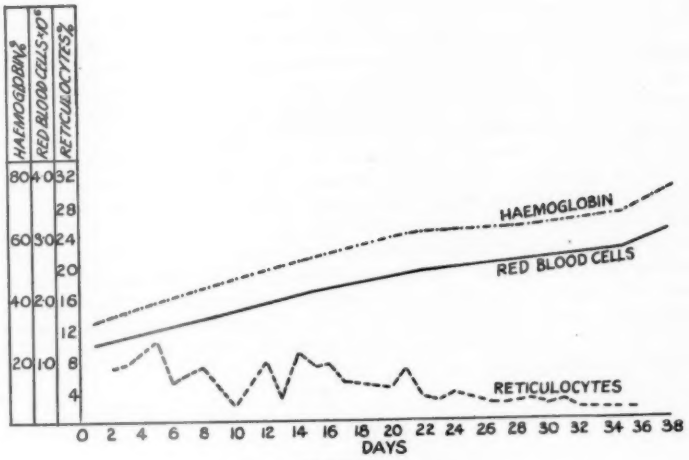


CHART II.

Case P. A. 212. Showing spontaneous remission—no treatment.

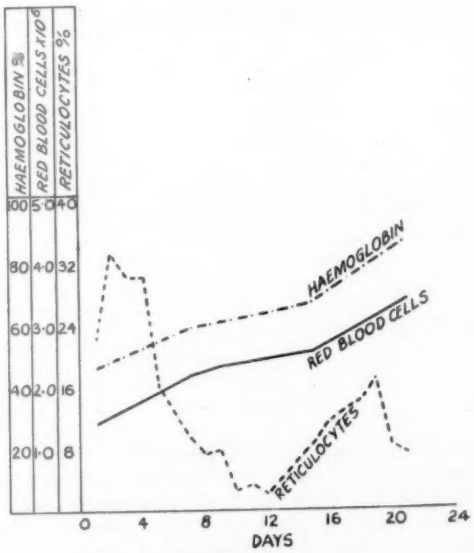


CHART III.

Case P. A. 107. Spontaneous remission—no treatment.

necessary, since the tests are repeated on at least two or three further patients complying with the above criteria.

The importance of the control period is shown by the two cases in Charts II and III, in which it will be seen that the initial reticulocyte counts were raised, subsequently running irregular courses before returning to normal, while both cases improved without any treatment whatsoever. It will thus be appreciated that erroneous conclusions might easily have been made if trial treatments had been administered in these cases. Hence it will be seen that in pernicious anæmia a so-called spontaneous remission (Charts II and III), or a remission initiated by suitable active treatment (Chart I) produces a reticulocytosis of a magnitude varying according to the initial red blood cell count followed by a rapid increase in the red cell count and hæmoglobin level. Further, once a remission has been initiated, it progresses considerably without further treatment. These are in accord with the observations of all workers. In my own series about 350 (out of some 400 cases) have had reticulocyte estimations carried out and shown similar responses but in nine unexpected abnormalities have occurred. Since these are of the nature of new and hitherto undescribed observations, I may draw attention to them here without attempting any explanation.

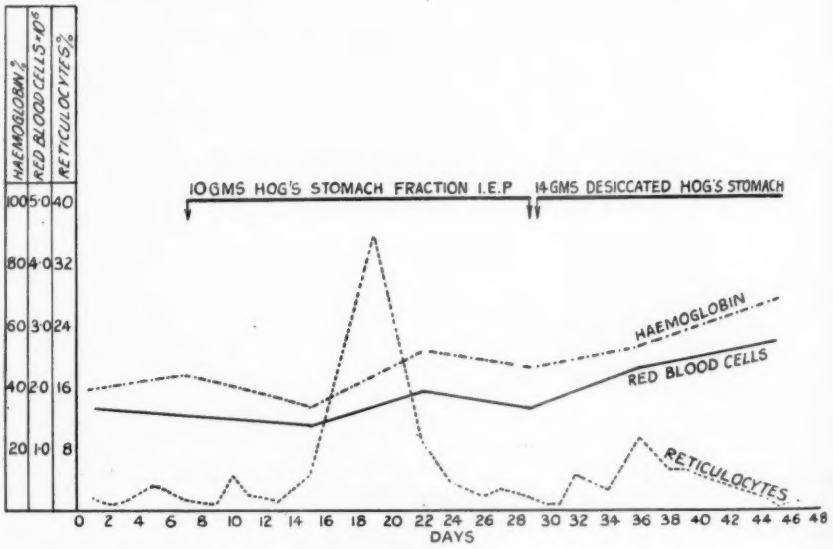

HAEMOGLOBIN %
RED BLOOD CELLS ·10⁶
RETICULOCYTES %
10 GMS HOG'S STOMACH FRACTION I.E.P
14 GMS DESICCATED HOG'S STOMACH
HAEMOGLOBIN
RED BLOOD CELLS
RETICULOCYTES
100 5·0 40
80 4·0 32
60 3·0 24
40 2·0 16
20 1·0 8
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48
DAYS

CHART IV.

Case P. A. 318.

These nine cases fell naturally into two groups:—

(1) Two cases apparently showing reticulocytosis without improvement in the red cell count or hæmoglobin after the administration of proved *inactive* stomach preparations, following adequate control periods. One of these cases was found subsequently to have a malignant involvement of the splenic flexure of the colon. It will be seen in Chart IV that although there was a slight temporary rise in the red cell count and hæmoglobin percentages, they fell markedly in the following week responding to an active stomach preparation with only a slight subsequent reticulocyte response, as was to be expected.

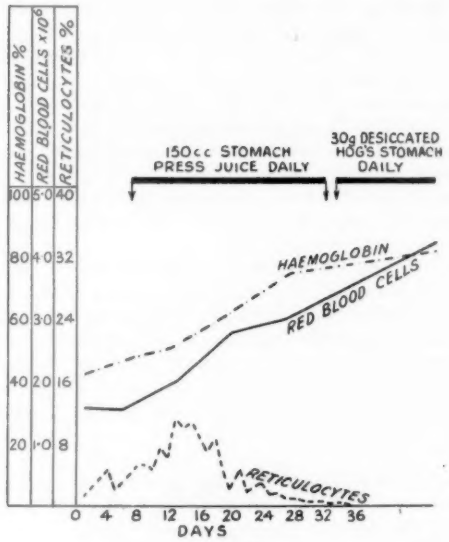


CHART V.

Case P. A. 199.

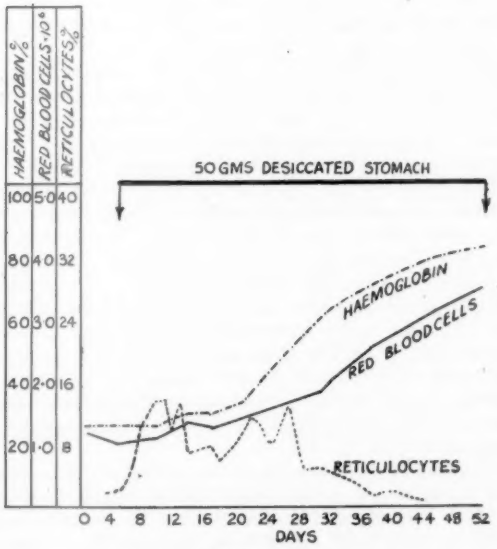


CHART VI.

Case P. A. 184.

(2) Seven cases showing only slight reticulocytosis followed by excellent red-cell and hæmoglobin responses after the administration of active stomach and liver preparations (Charts V and VI). Preliminary control periods were, of course, allowed and there had not been any previously observed reticulocytosis. As a rule in this group the phenomenon has only been observed when the red cells have been more than 1·25 millions and is not so striking as in Group 1. It should be noted, however, that the reticulocyte responses in these cases should have been four to six times greater than were actually observed.

Thus it will be appreciated that by insisting upon both reticulocytosis and red-cell increase in our clinical tests, we rule out the possibility of accepting inactive products as active ones.

Animal stomachs.—When we commenced the investigation of stomach therapy for anæmias nearly four years ago, the question arose as to the most suitable source of material from the point of view both of quantity and of cost. We had in mind that whilst probably all animals required a red-cell and hæmoglobin-producing mechanism, differences might possibly occur in the herbivorous, carnivorous and omnivorous types. From a consideration of the immediate problem it was obvious that a common omnivorous animal should offer the best starting point and we therefore utilized the pig.

It is unnecessary for me to repeat here the account of our results obtained with hog's stomach treatment; it will be sufficient to remind you that the extreme value of this treatment as a therapeutic agent has been amply demonstrated by a large number of workers. About two years ago [4] I illustrated the value of fresh stomach therapy by means of a series of blood-counts in one of my patients—Case No. 103. To-day, after three and a half years, that patient is still perfectly well, having taken fresh hog's stomach (2 lb. monthly) for over three years. In my own series of cases more than 97% of 264 cases on fresh or desiccated stomach only, during the last three and a half years (to December, 1932) have never had blood-counts of less than 4,000,000 red cells after discharge from hospital [4].

It appeared possible that carnivorous animals might furnish more active preparations and I considered the use of certain animal stomachs falling in this class. The obvious ones were of course from the cat and dog, but I was not able conveniently to obtain and use the large quantities of these that were necessary, on account of certain peculiar difficulties connected therewith. On the other hand such did not follow if one employed a more rare carnivore also available in this country—namely, the silver fox. Unfortunately, the supply of this is limited and can only be obtained during the brief pelting period of the year. Using this source, however, we have been able to show that the silver fox stomach is at least as active as the pig's stomach. Thus Chart VII shows the result of treating an adequately controlled case of pernicious anæmia with sixty desiccated silver fox stomachs. The initial dose was 15 grams daily, increasing to 30 grams. The response to this treatment commenced slightly earlier than would have been anticipated in the case of hog's stomach, although only half the dose was used. The patient was subsequently put on to an ordinary hog's stomach fraction and continued to improve. The desiccated fox's stomach was quite a pleasant powder with a peptic activity equal to that of ordinary hog's stomach.

Desiccated preparations of stomachs from the ox and sheep were examined in the early days, but we failed to get active responses in cases of pernicious anæmia. Thus in Case No. 113 (Chart VIII), even double the usual dosage failed after prolonged administration over forty-eight days, whereas hog's stomach produced an immediate response.

This was perhaps not unexpected, since neither desiccated sheep nor desiccated

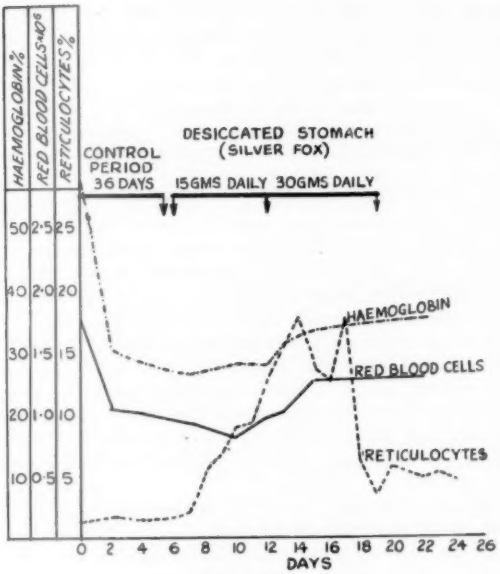


CHART VII.

Case P. A. 23.

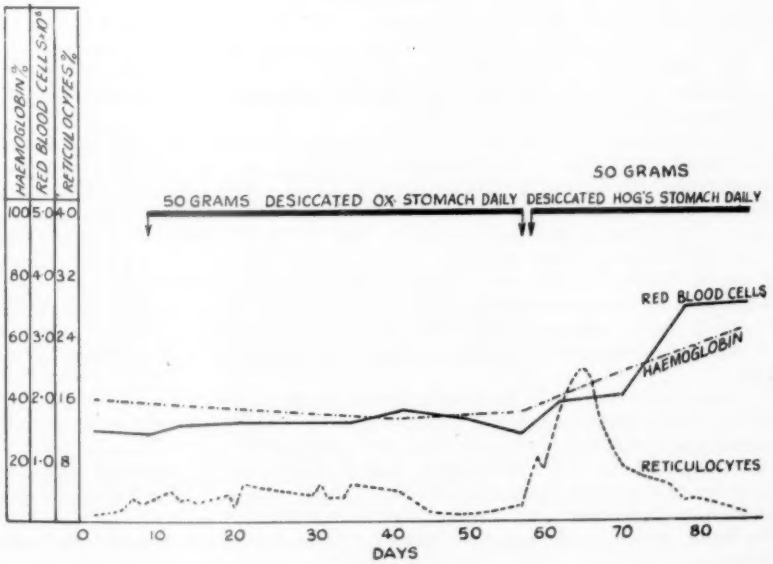


CHART VIII.

Case P. A. 113.

ox stomachs have any peptic activities, while there does not appear to be any reason why adult herbivorous animals should require proteolytic enzymes in their gastric juices. It is not improbable that the herbivore may have an hæmopoietic chain with one or more links differing slightly from its human counterpart.

Fractionation of stomach tissue.—Dr. Klein and I have been trying to isolate and identify the active principle in stomach tissue, and for this purpose have concentrated upon the pig's stomach, owing to its cheapness and the ease with which one can obtain the very large quantities that are necessary. In our early experiments four years ago the fresh tissue, in batches of up to 200 lb. or more at a time, was put through various manipulations without much success, although a great deal of valuable information was obtained. Since then we have employed several tons of stomachs, in both the raw and desiccated form, with more promising results. Several factors were found to destroy the active stomach principle, and consequently led to the formation of inactive stomach extracts. Among the most striking of these were (*a*) exposure to temperatures greater than 45° C., (*b*) autolysis, (*c*) prolonged digestion with pepsin or trypsin.

Moreover it was not found possible to obtain active stomach extracts by methods of extraction analogous to those employed in the case of liver. It appeared, therefore, that the active principle for which we have temporarily suggested the name "hæmopoietin" was much more unstable and had different properties from the active principle in liver [6].

After much tedious work and many negative results we have been able to obtain active products from fresh hog's stomach in the following manner (the chemical details are omitted here and are being published with Dr. Klein [7]): By exposing the tissue, mixed with sand, to high pressure a press juice was obtained having hæmopoietic and peptic activities. [*Slides were shown of the special apparatus employed for this purpose.*] This press juice is a reddish, opalescent, rather viscid liquid which decomposes rapidly in about twenty-four hours at room temperature, but keeps well in a refrigerator. We obtained good yields of the order of 560 to 670 c.c. per kilogram of fresh tissue, using a pressure of 2½ tons per square inch, but rather less quantities when employing the fresh mucosa only. The administration of 150 c.c. daily to four patients suffering from pernicious anæmia gave characteristic responses (Chart IX).

By precipitating this press juice with alcohol we have obtained a protein fraction (P.5) in which the whole of the hæmopoietic activity, as well as pepsin, appears to be concentrated, the alcoholic filtrates being inactive. The active principle of liver, on the other hand, is always found in the filtrate obtained after the removal of proteins. The yield of this product (P.5) was 30 to 36 grams per litre of press juice, so that 1 gram was equivalent to about 30 c.c. of juice, or 50 grams of fresh whole stomach. It was a light, cream-coloured powder, partially soluble in water, and having a very strong peptic activity. By the administration of doses of 5 grams daily, excellent responses have been obtained clinically (Chart X) and a similar preparation from the pressed mucosa had a rather greater clinical activity.

We have endeavoured to fractionate this product (P.5) in a variety of ways, but, as I have already indicated, pepsin always appeared to be associated with the many hæmopoietically active fractions that we obtained. (*A slide was shown to demonstrate these*) [6] [7]. It appeared also that, as much of the inert matter was removed by the various manipulations, so did the "hæmopoietin" undergo either destruction or alteration.

We have, however, at last been able to prepare two fractions by iso-electric precipitation.

P.5 (i) appears to contain practically the whole of the pepsin, but is inactive clinically in daily doses of 7·5 grams.

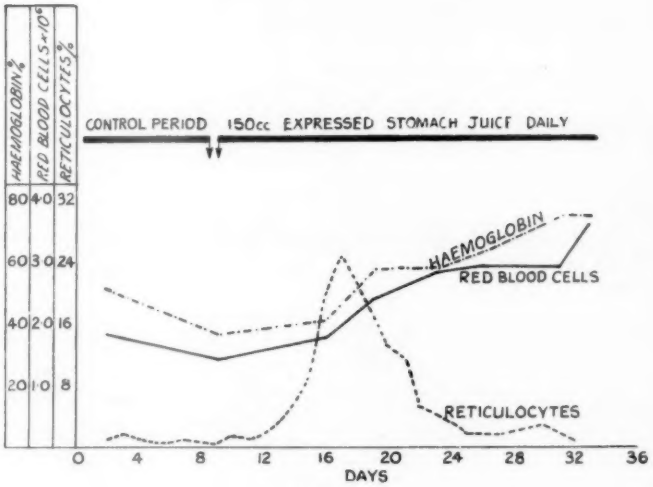


CHART IX.

Case P. A. 207.

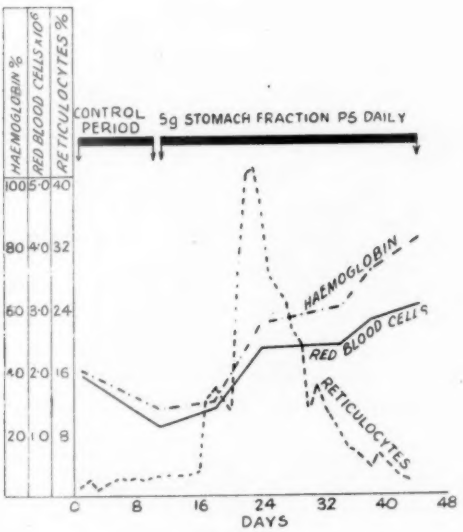


CHART X.

Case P. A. 280.

P.5 (ii) apparently is almost free from pepsin, but contains "hæmopoietin," and has given good responses clinically after the oral administration of 5 grams daily (Chart XI).

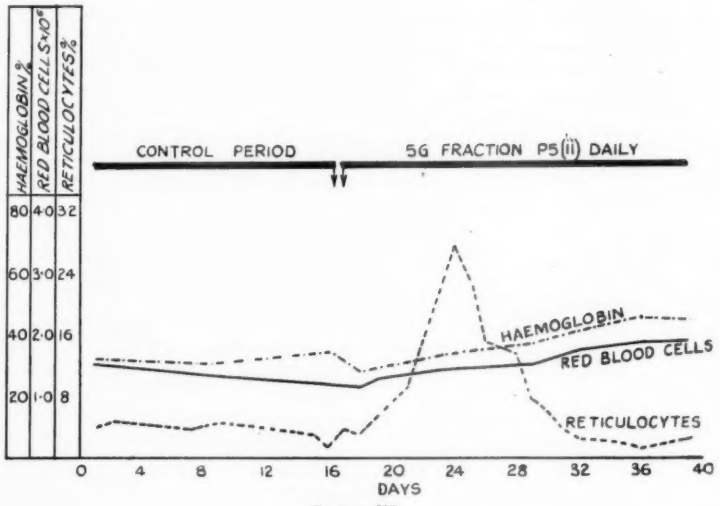


CHART XI.

Case P. A. 295.

It is a light fawn-coloured powder, odourless, tasteless and almost completely soluble in water; it has a relatively high phosphorus content (3·6%), and is practically free from copper, manganese and iron.

Further investigations are now in progress, using this fraction.

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2 WILKINSON, J. F., *Brit. Med. Journ.*, 1930 (i), 236.
3 Id., *Quart. Journ. Med.*, 1932, N.S., i, 361.
4 Id., *Proc. Roy. Soc. Med.*, 1931, xxiv, 56; 1933, xxvi, 632.
5 Id., *Brit. Med. Journ.*, 1932 (i), 85.
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7 Id., *Biochem. Journ.*, 1933, xxvii, 600.

Clinical Section.

President—BERNARD MYERS, C.M.G., M.D.

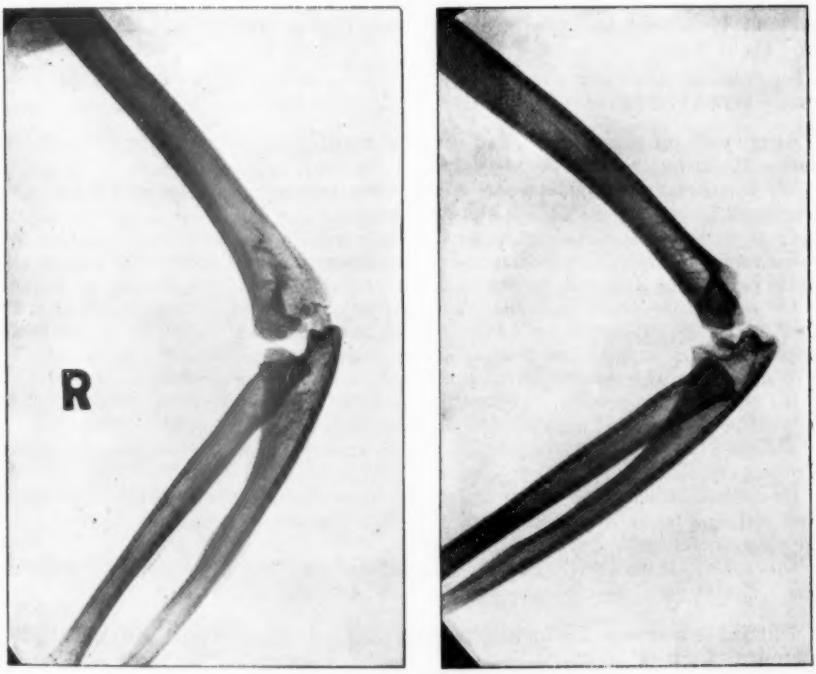
CASES SHOWN AT THE ROYAL WATERLOO HOSPITAL FOR WOMEN AND CHILDREN, MAY 12, 1932.

Cured Cœliac Disease : Achondroplasia.—P. M. DEVILLE, M.R.C.P. (for BERNARD MYERS, C.M.G., M.D., President).

James B., aged $8\frac{1}{12}$.

Second child. Five other children in family, all normal. Birth weight 10 lb. Breast-fed for eight months. Treated in 1929 for cœliac disease, which is now cured.

Until 1928 he seemed to grow normally, but since then has grown very little. About six months ago the mother noticed that he could not fully extend his



Skiagrams of case of achondroplasia. Note cup-like diaphyses.

elbows (see fig.). Stools now normal. Intelligence good. Genitals well developed. Standing height $39\frac{1}{4}$ in. Sitting height $22\frac{1}{4}$ in. Legs 17 in. Weight 2 st. 8 lb. Blood-count normal. Blood-urea 14 mgm. % ; blood-calcium 9·9 mgm. %; blood-phosphorus 4·9 mgm. %.

Skiagram of long bones shows changes consistent with achondroplasia.

Dr. CECIL BULL said that the striking feature shown in the skiagrams was the delayed ossification, the degree of development being equal to that of a child of 3. Delayed ossification might be part of a severe malnutrition, such as cœliac disease or rickets, but such delay was relatively slight and always made good when the cause was removed.

Hypofunction of the thyroid was the principal cause of gross delay, and in this child was probably a factor, if not the whole cause. If that was so it could be demonstrated by feeding with thyroid, which would restore the bones to normal.

He agreed that achondroplasia could not be excluded, because these bone conditions did not always run true to type, but in this child the shafts of the bones were delicately formed, unlike those of achondroplasia. The irregularity of the epiphyseal lines might result from the malnutrition of cœliac disease.

Diabetes Mellitus.—P. M. DEVILLE, M.R.C.P., M.R.C.S. (for Dr. BERNARD MYERS).

Edward A., aged 8.

This child was admitted into hospital in 1930 with diabetic coma. With 4 units of insulin daily his urine was kept sugar free. Until May, 1932, he kept fairly well, and was sugar-free on 20 units daily. Since then the disease has progressed more rapidly, and he is now having 64 units daily. In February, 1933, he had an attack of bronchitis and pleurisy. His weight has practically been stationary, round about 4 stone, since January, 1931.

The PRESIDENT said that a point of interest in this case was that, as usual in these cases, the child grew normally in length, but was a little light in weight.

Aneurysm of External Iliac Artery complicated by Gangrene of the Foot.—T. HOLMES SELLORS, F.R.C.S.

W. K., male, aged 58, admitted under the care of Dr. Claude Elman, with gangrenous left foot and swelling high in left groin.

Previous history.—Cramp-like pains in left calf, particularly after exercise, for twelve months previous to admission. One month before admission severe and sudden pain in leg, followed by dry gangrene of foot.

On admission.—Left foot black and shrivelled, showing a line of demarcation below the ankle. In the groin a swelling, the size of a hen's egg, palpable just below Poupart's ligament, but more definite above, with expansive vascular pulsation.

Wassermann reaction negative on two occasions. Blood chemistry normal.

No cardiac abnormality. Pipe-stem arteries. Blood-pressure 138/84. Left popliteal pulse palpable, but no arterial pulsation below that point.

Treatment.—Digital pressure applied below aneurysm for two weeks to encourage collateral circulation.

Operation, January 17, 1933. Curved incision ligature of artery above and below aneurysm, and ligature of deep epigastric artery. Aneurysm adherent to surroundings and incorporated with Poupart's ligament.

Operation, January 24th, 1933.—Amputation below knee; anterior and posterior flaps. No return of pulsation in aneurysm.

Partial Forward Dislocation (? Cause) of Fourth on Fifth Lumbar Vertebra, with Secondary Sciatica.—T. HOLMES SELLORS, F.R.C.S.

C. P., male, aged 56, a sailor. Complained of pain in right hip and leg on walking. No history of injury, apart from a recent accident to right knee.

Examination.—Spine: Movements of lumbar spine markedly diminished. Projection of spinous process of fourth lumbar vertebra.

Wasting of glutei. Tenderness over sacro-sciatic notch, down course of right sciatic nerve in particular. Slight contracture and spasm of right hamstring muscles.

Radiographical report.—Generalized osteo-arthritic changes in spine. Lateral view: Fourth lumbar vertebra projected forwards on fifth. Anteriorly: Joint space narrowed.

Treatment has aimed at symptomatic relief of sciatica. If the condition does not remain stationary the question of spinal fixation will be considered.

Purpura, with Transient Lesion of Mid-Brain.—H. A. DUNLOP, M.D.

Edith W., aged 10. The chief hæmorrhage was nasal, but there have been petechiæ and ecchymoses. Capillary resistance test repeatedly negative. Platelets at one time 25,000 per c.mm. One transfusion given.

Soon after first admission patient suddenly began to stagger about and had (?) diplopia. The diplopia lasted two days, the staggering gait longer.

Examined then, she had ataxia (slight) of left arm, weakness of left lower face, total right internal ophthalmoplegia with moderate ptosis and marked weakness of superior rectus. Left plantar reflex indefinite, right flexor. Order of recovery was: (1) arm; (2) face; (3) accommodation; (4) superior rectus.

Discussion.—The PRESIDENT said that, as the reaction to the capillary resistance test had lately become slightly, but definitely, positive, it might be desirable later on to perform splenectomy.

Dr. T. H. WHITTINGTON said he thought that the lesion affecting the parts supplied by the third nerve was nuclear. Convergence and accommodation, levator palpebræ and the superior rectus muscles, are all supplied by the anterior part of the third nerve nucleus, and were likely to be affected together by a nuclear lesion (as they were in this case). It was the sixth nerve nucleus which dealt with conjugate deviation—the right sixth nucleus being closely connected with the lower part of the left third nucleus which supplied the left internal rectus, so that the right sixth controlled movements of both eyes towards the right. If, therefore, the upper part of the third nerve nucleus was affected (as he suggested it was) all the ocular phenomena were explained. He also suggested that petechial hæmorrhages were likely to affect nuclei rather than nerve fibres.

Dr. LE MARQUAND said that if the condition were one of primary purpura hæmorrhagica, ligation of the splenic artery might be tried instead of splenectomy. He quoted the excellent results obtained by Van Goidsenhoven[1] by this procedure in acute and chronic purpura hæmorrhagica.

? Inflammatory Lesion in Cervical Cord.—H. A. DUNLOP, M.D.

Mrs. M. B., aged 19.

History.—Sudden onset of loss of power in left hand, followed by gradually developing weakness of legs. No pain.

On examination.—Band of anæsthesia to pin-prick on seventh cervical area of left side. Marked weakness and slight wasting of small muscles of left hand; remaining muscles less weak. Left upper limb rather ataxic. Weakness of legs; gait unsteady. No sensory loss in legs. Left ankle clonus. Double extensor plantar reflex.

Cerebrospinal fluid: Total protein 0·06. No obvious excess of globulin. Fehling's reduced normally. Cells 7 per c.mm. Wassermann reaction negative. Cultures sterile.

Subsequent progress.—Improvement gradual. Disseminated sclerosis cannot be excluded.

Giant-celled Tumour of Sacrum.—ST. J. D. BUXTON, F.R.C.S.

B. G., female, aged 27, complained of pain at bottom of back, on left side, since June, 1932. Before that time she was active and enjoyed athletic games. She was treated for strained muscles and was later manipulated twice under anæsthesia with no improvement. In January, 1933, she went to bed with "sciatica," the pain extending down to the toes; since then pain has persisted. A gynæcologist examined her and found no abnormality. She came under my care in March, 1933, when she had severe pain in the lower part of the back, extending down the left thigh. The left gluteus maximus and left calf were tender. Kernig's and Trendelenburg's signs positive on left side. Knee-jerks equal; no ankle-jerk obtained on left side. Skiagram showed extensive destruction of left side of sacrum, but sacro-iliac joint was not involved.

[1] F. van Goidsenhoven, "Le traitement de la thrombopénie essentielle par la ligature de l'artère splénique," *Rev. Belge des Sci. Méd.*, 1929, i, 97.

A physician reported that there were no signs of tuberculosis in the chest. A skiagram of the chest showed no abnormality.

Blood Wassermann reaction negative; no Bence-Jones protein present in urine. Blood-count: R.B.C. 4,900,000; Hb. 92%; W.B.C. 8,000; polymorphonuclears 69%. Red cells and platelets normal.

In view of the difficulty of diagnosing from the clinical findings and examination, exploration was undertaken.

Operation performed under general anæsthesia March 23, 1933. There was no abnormality outside the sacrum, but there was an opening into the sacrum large enough to admit two fingers. Material resembling blood-clot, with soft brownish tumour-tissue, was removed from this and the wound was closed.

Microscopic section showed the growth to be a giant-celled tumour, probably of the osteoclastoma type.

The pain was relieved. There is no reason to suppose that metastases will occur, and it is hoped that the deep X-ray therapy which the patient is having at present will cause the tumour to subside.

Dr. F. A. KNOTT said that on microscopic examination of a section, the histological appearances of the tumour were those, in the older terminology, of a giant-celled sarcoma or, in the more recent, of an osteoclastoma. He had never before seen one of these developing in the sacrum, the long bones being the usual site where, although the bone might be eroded and greatly expanded, there was little tendency for the tumour to invade the surrounding tissues or to form metastases. In this case, therefore, in spite of the unusual site, it seemed justifiable to expect that local treatment such as Mr. Buxton had described would be entirely successful.

Maternal Obstetrical Paralysis.—ST. J. D. BUXTON, F.R.C.S.

M. S., a married woman, aged 39, found weakness in her left leg when seven months pregnant with her second child. This weakness developed and there was foot-drop.

She attended my out-patient department when the child was nine months old. It was then found that the left anterior tibial group of muscles were paralysed, and that the gastrocnemius was short. It was difficult to determine if there were any sensory changes. The pelvis was normal and X-rays revealed no abnormality.

In January, 1933, the tendo Achillis was lengthened by subcutaneous tenotomy and the leg put in plaster. Subsequently a walking apparatus and night-splint were provided and electrical treatment was carried out.

Recovery of the muscles was first noticed in April, 1933.

Papilloma of Bladder.—J. C. AINSWORTH-DAVIS, F.R.C.S.

Mrs. S. S., aged 65.

Painless hæmaturia, lasting for a few days, noticed eighteen months ago. Second attack of hæmaturia four months ago. Seen by me at this hospital 6.3.33. Frequency: Day, 4-hourly; night, twice. No dysuria. Bowels constipated.

Cystoscopic examination: Benign papilloma of bladder.

The results of this treatment up-to-date have been extremely good, but the patient is not yet completely cured.

Severe Bilateral Œdema of the Eyelids for Thirteen Years.—T. H. WHITTINGTON, M.D.

Thomas M., aged 72, laundryman; never been abroad. Suffering from œdema of the eyelids, extreme on the left side. Left eye closed by swelling, and has been so closed for three years. Right upper lid would droop over eye, but patient is enabled to see by a ptosis support fitted to his glasses (for high myopia).

Previous history.—First seen October, 1920, having had gradually increasing swelling of eyelids for six months, and during the last few weeks diplopia in a

vertical direction. Movements of the right eye were then found to be very limited, except in a vertical direction. This was apparently due to mechanical causes associated with a severe œdema of the conjunctiva (chemosis) and of the tissues around the eye. The left eye and lids showed similar changes to a much less degree. Skiagram (in 1920) of orbit, peri-orbital sinuses and of surrounding parts quite normal. Nose and Throat Department reported normal findings throughout. Wassermann reaction negative. Vision not affected except mechanically.

Seen again in 1931. Lids had been continuously swollen, with slight variations, the right side getting better, and the left side getting much worse, the left eye being completely closed for over a year. Radiological report (Dr. Graham Hodgson) "Shows no abnormalities of orbit or of accessory sinuses; all sinus views taken."

Bilateral œdema of lids for thirteen years: Present condition (1933).

(Photograph taken immediately after removal of glasses with ptosis support; otherwise right upper lid droops over eye).

At the present time the left eye is almost fixed, owing to the œdema around it, and shows some proptosis. Vision, when the lids are forcibly separated, does not appear to be affected. The patient formerly worked much with alkali powder in his business. He is in good general health for his age, and shows no signs of organic disease, the urine having been normal throughout. He comes of a long-lived family; at the age of 65 he broke an arm when starting a Ford car.

The condition would appear to be a very rare one. No local or constitutional disease is evident to account for it, nor has there been any preceding condition such as erysipelas. I have not been able to find any record of such a case. In 1899

Sir Anderson Critchett reported a case somewhat similar in appearance, but in that case the œdema was solid (there was no chemosis) and was secondary to lymphangitis following erysipelas (*Trans. Ophthalm. Soc.* 1899, xix, 7). Several cases of that nature have been reported but, so far as I can ascertain, there is no record of any similar to the present case.

General Adenitis: Case for Diagnosis.—KENNETH PLAYFAIR, M.B.

Mrs. B. S., aged 52. Attended hospital on account of peri-articular rheumatism and amenorrhœa from March, 1928, to 1932. In 1931 she noticed a swollen gland on the right side of her neck. In 1932 (six months later) swellings were palpable on both sides of the neck, in both axillæ, in both groins, in the abdomen and in the left supratrochlear region. The mediastinal glands were also found to be enlarged.

Temperature, apyrexial. Wassermann reaction, negative. Urine: nothing abnormal discovered.

Blood-count.—April, 1932: R.B.C. 4,600,000; Hb. 82%; C.I. 0·89; W.B.C. 5,000. *Differential*: polys. 52%; eosinos. 2%; basos. 1%; large hyals. 12%; small and large lymphos. 33%. Red cells show no significant abnormality. No abnormal types of white cells. June, 1932: R.B.C. 4,500,000; Hb. 84%; C.I. 0·93; W.B.C. 8,200. *Differential*: polys. 67%; eosinos. 2%; basos. 1%; large hyals. 6%; small and large lymphos. 24%. Red cells, normal. Platelets, normal. No abnormal white cells.

The glands varied in size from time to time, and the patient thinks that they are now definitely smaller than they have been previously. She has always felt quite well in herself. About four months ago she had an attack of herpes in the left supraclavicular fossa; she has also had recent hot flushes. A gland was excised in June, 1932, for section.

Pathological report: "The section of the gland itself shows gross hypertrophy of the lymphoid tissue with very little increase of the supporting tissue. Very few new properly formed vessels occur, and at the edge of the gland the capsule is cloven through by masses of lymphoid cells which are invading the subcutaneous tissue and muscle layers. The section is suggestive of lymphosarcoma."

Skiagram of chest: No evidence of pulmonary lesion.

Osteitis Deformans.—KENNETH PLAYFAIR, M.B.

Mrs. C. F, aged 56, first attended hospital February, 1930, on account of head-noises, headaches, and pain in the right upper abdomen. Tenderness over gall-bladder; liver slightly enlarged. Diagnosis of gall-stones was made.

Laparotomy March, 1930; nothing abnormal found except adhesions between the liver and the diaphragm on the right side. Patient was seen by Mr. Beevor; report: "nerve deafness."

Seen by me, July, 1931. Muscle weakness. No change of sensation. Sent to Mr. Buxton, who diagnosed osteitis (? deformans, ? fibrosa). Treated with ultra-violet light, electricity and massage. Showed some improvement—there was less dragging of the leg. Now complains of pain in the back. Has noticed her skull growing larger. Skiagrams of skull: Long bones and pelvis show typical changes of osteitis deformans.

Blood (fasting).

Serum	Per cent.		*Whole Blood*	Per cent.	
Alkali reserve ...	58 c.c.		Cholesterol ...	180 mg.	*
Cholesterol ...	200 mg.	*	Sodium chloride ...	450 mg.	
Sodium chloride ...	670 mg.		Inorganic sulphate	2 mg.	*
Total protein ...	10·5		Lecithin ...	20 mg.	*
Calcium	16 mg.	*	Uric acid ...	3·4 mg.	
Sodium	450 mg.	*	Urea	48 mg.	
Potassium	17 mg.	*	Amino nitrogen ...	6 mg.	
Inorganic phosphorus	2·8 mg.	*	Creatinine ...	2 mg.	
Magnesium	4 mg.	*			

* Note that the figures for magnesium, calcium, cholesterol and lecithin are all raised above normal; that for inorganic phosphorus is low.

Two Cases of Inguinal Hernia (Scrotal) cured by the Injection Method.
—ST. GEORGE B. DELISLE GRAY, F.R.C.S.Ed.

Fredk. B., aged 71, when first seen in the autumn of 1931, had a large double hydrocele of fourteen years' standing and a right inguinal hernia of ten years' standing. He had attended hospital for many years at frequent intervals to have the hydroceles tapped. Owing to the hydroceles it was impossible to fit an ordinary truss and he was given the bag truss which is here shown (fig. 1).

FIG. 1.

FIG. 2.

Before treatment.

With much trepidation, in view of the long history and of the thick walls of the sacs, the hydroceles were evacuated seriatim and each was injected with 10 c.c. quinine-urethane and cured. The harness was then too large and quite unnecessary, as the right inguinal hernia, which was about the size of a fœtal head (fig. 2), could now

FIG. 3.—Present condition. 14.7.33.

be quite easily retained by a spring truss. The external ring was large and easily admitted the third finger as far as the metacarpo-phalangeal joint and the external oblique could be lifted from the subjacent layers.

The injection of the hernia was begun on January 4, 1932, and between that date and August 8 twenty-four injections of Ignatz Mayer's solution were given into

the right inguinal canal. On September 5 the patient left off wearing the truss at night and since October 3, 1932, he has left off wearing it altogether. There is not the slightest sign either of hydroceles (which had a capacity of over a litre altogether) or of hernia, and it may be reasonably claimed that a cure has been effected (fig. 3.)

George G., aged 69. Was discharged from the Royal Navy in 1889 with a right inguinal hernia for which he had received a "hurt certificate." When first seen by me in April, 1932, he was wearing an incompetent right inguinal spring truss and he had a right scrotal hernia and a left inguinal hernia the size of a bantam's egg. He was fitted with a double inguinal spring truss (rat-tail type) and the first injection was on May 2, 1932. The right external ring admitted the middle finger.

Eighteen injections of Ignatz Mayer's solution were given on the right side and seventeen on the left side, the last on the right side being given on August 11. The truss was left off at night on September 12 and finally discarded on October 10, 1932. For details of technique the reader is referred to the *British Medical Journal*, 1932 (ii), 12.

The PRESIDENT said that the results were excellent and that this method might prove valuable for cases in which it was not desirable to give an anæsthetic, and also for aged patients.

Section for the Study of Disease in Children.

President—LEONARD G. PARSONS, M.D.

[*May* 26, 1933]

Ankylostomiasis.—EDMUND CAUTLEY, M.D.

Margaret C., aged 7½ years, admitted to the Belgrave Hospital for Children on May 1, 1933, on account of headache, languor and anæmia.

She has lived for a year in Hong Kong, where she was well, except for varicella; she returned twelve months ago. For eight months past her mother has noted pallor, gradually increasing. During the last three months the child has complained of almost daily headaches, weariness, and breathlessness, especially on exertion. Fair appetite. Constipated for several months.

Condition on admission.—Complexion pale and sallow, the conjunctivæ specially so. Sub-normal temperature. Pulse 112; respiration 24. Nothing else found abnormal, except a slight albuminuria.

	R.B.C.	Hb. %	C.I.	W.B.C.	Eosinos. %
Blood examinations: May 4	4,712,000	48	0·51	11,220	6
,, 6	4,112,000	43	0·53	8,400	10·8
,, 12	5,072,000	54	0·53		

Ova, probably those of *Necator americanus*, were found in the stools on May 11.

[Specimens of ova, larvæ, and an adult female worm were exhibited.]

Anæmia of Von Jaksch.—ALAN MONCRIEFF, M.D.

Patricia W., aged 8 months, the only child of healthy parents, came under my care at the Bolingbroke Hospital two months ago on account of "loss of weight and appetite." She had been ailing for two weeks. Previous health good, except for bronchitis in December, 1932.

On admission (31.3.33).—Very pale, with curious purpuric spots on the scalp. Liver enlarged; spleen much enlarged and firm. Blood-count: R.B.C. 1,600,000; Hb. 26%; W.B.C. 28,500. *Differential*: Polys. 34·5%; basos. 1·8%; large hyals. 4·1%; lymphos. 54·3%; myelos. 3·2%; metamyelos. 2·1%. Nucleated R.B.C. (normoblasts and megaloblasts) 130 per 1,000 white cells. Marked poikilocytosis, polychromatophilia and anisocytosis. Wassermann reaction negative. The child had been fed on a proprietary food, without orange-juice or cod-liver oil, and this was continued at first, with the sole addition of 5 gr. of iron and ammonium citrate thrice daily. After ten days the blood-count was: R.B.C. 1,950,000; Hb. 36%. After eighteen days of the same treatment the red cells were 2,500,000, and hæmoglobin was 47%. The iron was increased to 21 gr. per day, and the count rose to 2,700,000 red cells and 53% hæmoglobin. Copper sulphate gr. $\frac{1}{8}$ was added to each dose of the iron and ammonium citrate, but no further improvement took place. "Yestamin" was then added, but no effect was obtained on the blood-count. The dose of iron and ammonium citrate was reduced to 9 gr. a day on account of a gastro-intestinal upset, and red blood-cell count dropped slightly to 2,400,000, and 43% of hæmoglobin. On 13.5.33 a blood transfusion of citrated whole blood was attempted, but only a very small quantity was introduced. This is being repeated. Meanwhile, during the whole time the child has been in hospital there has been some degree of fever, and *B. coli* without pus cells have been seen in the urine. This condition has been treated, and the urine is now normal. The diet has been changed recently to full-cream dried milk, with the addition of fruit juice and cod-liver oil daily. The spleen has remained the same size since admission. There have been no further hæmorrhages under the skin. The differential blood-count has also remained much the same since admission.

A second blood transfusion of 60 c.c. was given on 20.5.33, since when the condition has greatly improved. Blood-count, 22.5.33: R.B.C. 3,960,000; Hb. 78%; W.B.C. 13,000. *Differential*: Polys. 30%; lymphos. 60%; monos. 6%; basos. 1%; myelos. 3%; nucleated reds 2 per 100 white cells with polychromatophilia and a few stippled red cells.

Three Types of Hæmolytic Anæmia in the New-born.—HELEN MACKAY, M.D., and E. O'FLYNN, M.D.

I. PURE HÆMOLYTIC ANÆMIA IN THE NEW-BORN OR SEVERE ANÆMIA WITHOUT JAUNDICE.

(i) Lily B.

Family history.—Mother: aged 37 years. Appears in fairly good health. Previous pregnancies: five; all full term; first two normal. Third child—jaundiced and pale for (?) first three weeks of life. Fourth child—jaundiced and pale for first three weeks of life. Fifth child—jaundiced (? when born); died on tenth day with deep jaundice and bleeding from the navel.

Last three infants presumably suffered from icterus gravis of the familial type, and the father anxiously inquired of the ward sister whether the child shown to-day was "going yellow." An aunt on the maternal side was jaundiced when born, could not walk until seven years old, and is now a certified mental defective. There is no consanguinity between the parents.

History of illness:—

Date	Age	Weight lb. oz.	Clinical history	Blood-examination	Treatment
27. 2.33	Birth	6 10	Born in Mothers' Hospital, Clapton		Breast-fed throughout period of observation.
4. 3.33	5 days	6 6	Baby reported normal at midday by ward sister		
5. 3.33	6 days		Striking pallor twenty-four hours later; no definite jaundice of skin. Baby lethargic		14 c.c. citrated blood given intramuscularly.
10. 3.33	11 days	6 3½	First seen by H.M.M.M. Pallor still striking, but colour said to be definitely improved. Sucking better. Spleen palpable. Glands in neck and axilla slightly enlarged. Loud systolic murmur over cardiac area	Hb. 40%	
14. 3.33	15 days	6 6	Colour better	Hb. 46%	
21. 3.33	22 days		Glands still slightly enlarged. Spleen palpable. Systolic murmur disappeared	Hb. 60% R.B.C. 2,610,000 per c.mm. W.B.C. 20,600 per c.mm.; polymorphs.30%; lymphos. 60%; transitionals 4%; hyalines 6%. Normoblasts 5 per 100 W.B.C. Polychromasia and hypochromia present. Coagulation time 120 sec. (normal adult 90 sec.) Bleeding time not prolonged Van den Bergh: weak indirect reaction Fragility: no hæmolysis in 0·525% saline; slight hæmolysis in 0·56%; complete hæmolysis in 0·40%	Iron and ammonium citrate started and believed to have been given regularly from this date.
24. 3.33	25 days	7 2	Still looks very pale, but colour improving. Spleen still palpable		
31. 3.33	32 days	7 10	Spleen not palpable	Hb. 64%	
21. 4.33	1¾ months	9 0		Hb. 70%	
18. 5.33	2¾ months	10 8¼	Colour good. Nutrition good	Hb. 70% R.B.C. 3,310,000 per c.mm.; W.B.C. 9,060 per c.mm. Films: no abnormality except slight anisocytosis	
9. 6.33	3½ months	11 8		Hb. 70%	
14. 7.33	4½ months	13 6		Hb. 78%	

(ii) Elizabeth B.

Family history.—Mother: Age at birth of child, 31 years; has been three times in mental hospital. Wassermann reaction during pregnancy and again in puerperium negative. Blood-count (a few days after confinement): Hb. 78%; R.B.C. 4,020,000 per c.mm; C.I. 0·9; W.B.C. 6,930 per c.mm. Pregnancies: First five children full term, living. Sixth pregnancy, full term, stillborn; seventh pregnancy, full term, child died jaundiced at two weeks old (? icterus gravis of the familial type). Eighth pregnancy, case shown (hæmolytic anæmia). Ninth pregnancy, seven months, stillborn, "baby swollen up,"·? erythroblastosis fœtalis. Mother had "kidney trouble and swelling of legs" in last pregnancy—abdomen "very large"—and "after-birth twice as big as it should be."

Father: Health apparently good. Occupation: baker.

History of illness:—

Date	Age	Weight lb.	Weight oz.	Clinical history	Blood-examination	Treatment
12. 2.30	Birth	7	4	Born in Mothers' Hospital, Clapton		Breast-fed
16. 2.30	4 days			Slight jaundice noticed		
18. 2.30	6 days	6	13½	Marked pallor, with little or no jaundice. Spleen palpable. Systolic murmur at base of heart	Hb. 28% R.B.C. 1,510,000 per c.mm. W.B.C. 16,800 per c.mm.	Expressed breast milk.
19. 2.30	7 days			First seen by H.M.M.M.		20 c.c. citrated whole blood intramuscularly, 0·015 stabilarsan intramuscularly. Iron and ammonium citrate by mouth started and given regularly from this date.
20. 2.30	8 days			Pallor increased, baby blanched. Pyrexia, presumably due to blood-injection on previous day		
22. 2.30	10 days			Taking feeds well		Liver extract started in addition to iron.
25. 2.30	13 days	6	14½	Baby still blanched. Spleen larger	Hb. 20% (or less, blood over diluted) R.B.C. 1,500,000 per c.mm. W.B.C. 21,160 per c.mm.; polymorphs. 40%; lymphos. 52·5%; hyalines 2%; myelos. 5·5% Some nucleated red cells (including approximately 1 megaloblast per 100 W.B.C.) Anisocytosis, poikilocytosis and polychromatophilia present	
26. 2.30	14 days			Temperature rose to 105·2° following transfusion		Transfusion: abt. 50 c.c. of mother's blood (citrated).
28. 2.30	16 days			Colour rather better		
6. 3.30	22 days			Spleen still enlarged and rather firmer	Hb. 30% R.B.C. 1,700,000 per c.mm.	Sucking from breast again.
10. 3.30	26 days	7	3½	Baby much improved, spleen smaller	Hb. 38%	
1. 4.30	1½ months	8	3½	Spleen just palpable		Liver extract stopped; iron continued.
23. 4.30	2½ months	10	2	Spleen just palpable	Hb. 46%	
1. 5.30	2½ months				Hb. 46% R.B.C. 2,590,000 per c.mm. W.B.C. 6,200 per c.mm.; polymorphs. 45%; lymphos. 45%; eosinos. 2%; hyalines 8%	
18. 6.30	4½ months			Nutrition good, colour good, spleen not palpable	Hb. 72%	
17. 5.33	3½ years	31	12	Colour fairly good. Nutrition good	Hb. 90%; W.B.C. 13,600 per c.mm Films: slight anisocytosis	

II. Hæmolytic Anæmia with Icterus Gravis Neonatorum of Familial Type.

Kenneth H.

Family history.—Mother: Aged 32 years. Wassermann negative. Previous pregnancy: baby weighed 4½ lb. at birth and was not jaundiced when born.

Father: Worker at saw mills. No consanguinity between parents.

History of illness:—

Date	Age	Weight lb.	Weight oz.	Clinical history	Blood-examination	Treatment
27.11.32	Birth	4	1	Jaundice present at birth		Given expressed breast milk.
29.11.32	2 days	3	12½	Deeply jaundiced		
2.12.32	5 days			Pallor noted, with jaundice		
10.12.32	13 days			Vomiting; baby seemed worse		10 c.c. blood injected into buttocks.
14.12.32	17 days	4	1		Hb. 20% R.B.C. 1,069,000 per c.mm. (from ear)	
16.12.32	19 days			First seen by H.M.M.M. Jaundice still well marked. Spleen 1 in. below costal margin; liver slightly enlarged; systolic murmur all over cardiac area	Hb. 22% R.B.C. 1,487,500 per c.mm. W.B.C. 18,900 per c.mm. (from heel)	
19.12.32	22 days	4	4½	Spleen size as before, harder than normal. Slightly enlarged cervical glands in posterior triangle	Hb. 24% (from heel)	
22.12.32	25 days				Hb. 27% R.B.C. 2,160,000 per c.mm.	Iron and ammonium citrate started and apparently given regularly.
28.12.32	31 days	4	9		Hb. 30%	Feeding: breast milk supplemented with dried milk.
6. 1.33	1¼ months	5	1½	Spleen softer and slightly smaller. Liver still enlarged. Glands in neck scarcely palpable	Hb. 38% R.B.C. 2,630,000 per c.mm.	Cod-liver oil emulsion started.
20. 1.33	1¾ months	6	1½	Spleen still palpable. Liver definitely smaller	Hb. 50%	Feeding: dried milk.
24. 1.33		6	10½		Hb. 50%	
27. 1.33	2 months			Colour fair. Nutrition good. Heart n.a.d. Spleen still palpable. Liver: Not enlarged		
1. 2.33					Hb. 50% R.B.C. 3,600,000 per c.mm. W.B.C. 6,730; polymorphs. 36%; lymphos. 60%; myelocytes 2%; large mononuclears 2% Films: marked polychromasia and some stippling, marked anisocytosis. 2 normoblasts to 100 W.B.C. Reticulocytes over 2·5% Fragility test: no hæmolysis in 0·45% saline; incomplete hæmolysis in 0·425% saline; complete hæmolysis in 0·40% saline	
10. 2.33	2½ months	7	8	Spleen still palpable and harder than normal	Hb. 49%	
24. 2.33	Nearly 3 months	8	4		Hb. 52%	
10. 3.33	3½ months	9	0	Colour still pale. Spleen not felt	Hb. 56%	
7. 4.33	4½ months	10	2	Colour fairly good	Hb. 70%	
5. 5.33	5½ months	11	2		Hb. 77%	
7. 5.33	5¾ months	11	11	Small for age. Colour fairly good. Nutrition fairly good	Hb. 79%; R.B.C. 3,820,000 per c.mm.; W.B.C. 15,900 per c.mm.; slight anisocytosis and polychromasia	
16. 6.33	6¾ months	12	7	Looks well	Hb. 80%	
16. 7.33	7¾ months	13	1	Looks well	Hb. 82%	

III. Hæmolytic Anæmia in the New-born, Presumably due to an Intestinal Infection and Hepatitis.

Reginald J.

Family history.—Mother: Two previous pregnancies; full term; normal infants. Father: Engine driver.

History of illness:—

Date	Age	Weight lb. oz.	Clinical history	Blood-examination	Treatment
17. 8.32 20. 8.32	Birth	8 0	Reported normal at birth Reported to have jaundice and 5 to 6 stools daily		Breast-fed.
25. 8.32	8 days	8 6	Stools loose; jaundice reported to be much more marked from about this date		
1. 9.32	15 days	7 11½	Brought to hospital by midwife. Nutrition fairly good; fairly vigorous. Umbilicus normal. Fairly deeply jaundiced—lips pale. Liver slightly enlarged. Spleen slightly enlarged. Stools rather loose and green. Pyrexia lasting about twenty-four hours after admission		Mother and child admitted. Child treated as case of enteritis.
3. 9.32	17 days		Child improving. Stools much better. Jaundice diminishing	Hb. 42% R.B.C. 2,218, 750 per c.mm.	
9. 9.32	23 days		Spleen enlarged; ½ in. below costal margin	Hb. 34%	Iron and ammonium citrate started.
12. 9.32	26 days	8 0½	Very pale; jaundice disappeared Nutrition fairly good. Spleen still palpable	Hb. 44% R.B.C. 2,580,000 per c.mm. W.B.C. 8,250 per c.mm.: Polymorphs. 42%; lymphos. 58% Fragility test: slight hæmolysis 0·42% saline; complete hæmolysis 0·32% saline	
15.9.32	29 days	8 1¾	A non-lactose fermenter isolated from stool, agreeing in sugar-reaction with *B. aertrycke*. Patient's serum agglutinated this organism, also the standard type organism, in dilution of 1 in 25 (insufficient serum for further dilutions)		
22. 9.32	36 days	8 6	Colour distinctly better	Hb. 64% R.B.C. 3,240,000 per c.mm. W.B.C. 17,180 per c.mm.: Polymorphs. 48%; lymphos. 46%; eosinos. 3%; hyalines 3%	
21.10.32	2 months	10 5	Baby still pale	Hb. 60%	
18.11.32	3 months	12 3		Hb. 76%	
26.12.32	4½ months	13 9	Colour and nutrition good	Hb. 80%	
17. 3.33	7 months	17 15	Looks well	Hb. 71%	Appears to have been without iron treatment for some while.
17. 5 33	9 months	20 5	Colour and nutrition good. No enlargement of liver or spleen. Some enlarged glands in left axilla (? dating from vaccination)	R.B.C. 5,050,000 per c.mm. W.B.C. 17,600 per c.mm. Films: very slight anisocytosis	Having iron treatment again.

The four patients shown have all suffered from a hæmolytic anæmia, three within one week of birth, the fourth within two weeks of birth—and have made good recoveries.

The first two, Elizabeth B. and Lily B., are cases of the type which has been described under the titles of primary, idiopathic, congenital, or severe anæmia of the new-born. Striking pallor, with little or no jaundice of the skin, developed towards the end of the first week of life—in one case apparently the pallor developed in

the space of twenty-four hours, when the child was between five and six days old. The spleen and lymphatic glands showed some enlargement, and a loud systolic murmur appeared over the heart. These cases are generally held to be very rare. Drs. Eric Pritchard and Jean Smith in 1931 [1] could only find descriptions of fifteen such cases and references to fourteen others. Some further cases have been described since that date, and Bonar and Smith [2] in 1933 were able to bring the number of described cases up to nineteen though not all the cases were included in this list. We believe that these are true cases of hæmolytic anæmia—which we think probably exists in all grades from the most profound anæmia till it merges into the normal. We suggest that in the less severe cases the process of hæmolysis spontaneously diminishes and the infants recover, and that the cases are not nearly as rare as the paucity of records would suggest. The fact that there are here to-day three and possibly four cases of this type certainly suggests that its rarity has been exaggerated. This excessive blood destruction occurs at an age when in the normal infant the number of red cells is dropping as a result of hæmolysis, and there is much to suggest that the process is an exaggeration of this normal hæmolysis. The cases described by Segar and Stoeffler [3], Bonar and Smith and others, show that the condition may be familial.

The third patient, Kenneth H., was a baby born jaundiced, who rapidly developed deep jaundice and pallor—his hæmoglobin dropping to 20%. The clinical picture agrees very well with an icterus gravis neonatorum of the familial type, although there is no history of other jaundiced infants in his family.

Now an interesting point in connection with the first two cases, which we have called pure hæmolytic anæmia, is that children in the same families have suffered from a condition which was probably icterus gravis neonatorum. Ecklin [4] states that a sibling of his case died from icterus gravis at seventeen days old. Diamond, Blackfan, and Baty's review [5] of their own cases and those in the literature show cases of both types in the same families, and also the merging of one type into the other. Does not this suggest that the two conditions are closely related? In both there is rapid and excessive blood destruction, but in pure hæmolytic anæmia the products of hæmolysis are dealt with, and severe jaundice does not appear, whereas in familial icterus gravis, with a similar degree of blood destruction, there is, as Dr. Hampson has stated, failure to deal with these substances. If our suppositions are correct, milder cases of both diseases usually recover as a result of spontaneous arrest of the hæmolytic process. Whether the presence of large numbers of immature cells in the blood precedes the blood destruction, or, as seems more likely, is the result of an effort at regeneration following excessive blood destruction, is not yet definitely established—it would be interesting to hear the views of others on this point. Like babies suffering from hæmorrhagic disease of the new-born, these babies presumably suffer from some temporary deficiency in their blood, which can be made good by the injection of adult blood, thus tiding the baby over until such time as his own organs supply the needed substance in sufficient amount. Grulee and Bonar [6], and Diamond, Blackfan and Baty [5] have suggested that primary anæmia in the new-born and familial icterus gravis may be related to fœtal erythroblastosis—and the mother of Elizabeth B. describes the last child born to her as being "all swollen up." It was still-born, and the "after-birth was twice as big as it should be," which corresponds with the findings in this condition.

The last case, Reginald J., illustrates, I think, a hæmolytic anæmia due to a totally different cause, i.e., a microbial infection occurring in the neo-natal period. This child had apparently an intestinal infection which gave rise both to the anæmia and to a hepatitis. If this be so, then the jaundice was in part due to the hepatitis and in part hæmolytic in origin. The jaundice apparently did not appear until the

third day (which is late for an icterus gravis of the familial type) and rapidly deepened between the eighth and fifteenth days when the baby had loose green stools; dietetic treatment of the intestinal condition produced rapid improvement in the general condition. This case, however, illustrates the difficulty of differential diagnosis in the jaundice and anæmias of infants in the first weeks of life.

The first three cases were given injections of adult blood. Hampson has proved the value of adult serum in familial icterus gravis neonatorum; and in cases of what we would call pure hæmolytic anæmic of the new-born, transfusions have brought about recovery when the hæmoglobin had fallen even so low as 10%. It seems probable that this adult blood supplies a needed anti-hæmolytic agent. In the fourth case, where the anæmia was believed to be due to an infection, no blood injection was given.

All four cases shown were given iron. This was done as a routine, not because iron is necessary to produce immediate improvement in the blood-picture, but because it appears reasonable in all such cases to give prophylactic treatment before anæmia due to iron want supervenes. Certainly part of the products of hæmolysis are conserved for future use, but nevertheless iron want develops very early in some cases of hæmolytic anæmia.

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Chlorotic Anæmia with Dwarfism and Rickets.—LEONARD FINDLAY, M.D.

Patient, a girl, aged $9\frac{9}{12}$, is one of a family of seven girls, all the others of whom are living and well; the mother is also alive and well, but the father died one month ago from pneumonia.

The patient was a full-term child, weighing $7\frac{1}{2}$ lb. at birth, was bottle-fed, and is said to have thriven well; she cut her first teeth at 10 months, sat alone at 8 months but did not walk till 2 years.

At the age of 3 years she developed diarrhœa, the motions at times being grey and putty-like. Some months later she was admitted to Romford Hospital where she remained for ten months. On returning home she seemed listless and anæmic, and advice was sought at the Infants Hospital, Vincent Square, where she remained as an in-patient from September 26, 1927, till March, 1928. Here a provisional diagnosis of cœliac disease was made, and I am indebted to Dr. Jean Smith for the following notes of laboratory tests carried out during this period.

2.12.27.—Total fat content of dried fæces, 20·8%.
14.12.27.—Blood-examination: Hb. 62%; R.B.C. 4,680,000; W.B.C. 13,600.
17.12.27.—Fæces contain occult blood.
19.12.27.—Total fat content of dried fæces, 16%.
11.1.28.—Urine: No albumin or sugar.
26.1.28.—Total fat content of dried fæces, 28%.
10.3.28.—Total fat content of dried fæces, 35%.

On her discharge from the Infants Hospital she is said to have spent one year in Victoria Hospital for Children, Chelsea, but no record of this is obtainable. During the last three years she has been at home and, on the whole, has improved; the motions at times have been noted to be putty-coloured; she has continued pale, and a "knock-knee," observed on her discharge from the Victoria Hospital, has persisted. It was on account of this latter condition that she was referred by the Chelsea Clinical Society to Mr. Acton Davis, who passed her to the physician for investigation.

On admisson (5.4.33) to Princess Elizabeth of York Hospital for Children, she was noted to be somewhat obese but much undersized, measuring 40½ in. instead of the average 50 in., and under weight, being 49½ lb. instead of the average 72 lb. for her age. She was very anæmic looking, the mucous membranes being very pale, but the cheeks presented a reddish hue (chlorosis rubra), and the skin generally had a slight icteric tint.

The head was square (19½ in. in circumference). The epiphyses at the wrists enlarged, and there was a moderate degree of genu valgum. X-ray examination of wrists (fig. 1) and knees revealed active rickets.

6.4.33

FIG. 1.—Skiagram of wrist showing active rickets.

7.6.33

FIG. 2.—Skiagram of wrist showing definite healing after institution of Viosterol for eight weeks.

Physical examination of chest and abdomen negative; urine contained neither albumin nor sugar. Blood-pressure (right brachial) 120/62. Mantoux test negative. Motions infrequent, well coloured and formed, and with a total fat content of 20%.

Blood.—Hb. 33%; R.B.C. 3,010,000; C.I. 0·67; W.B.C. 9,000. In films poikilocytosis, anisocytosis, ring staining but no nucleated forms observed. Platelets 260,000 per c.mm.; reticulocytes 1·2%; fragility of red cells normal; bleeding time 3 min. 5 sec.; serum phos. 2·7 mgm. %; serum calcium 8·6 mgm. %; urea 30 mgm. %; fat balance over seven days: 95·6% of intake absorbed.

Renal efficiency tests: (*a*) urea concentration (15 grm. urea):—

Before urea ...	110 c.c. urine	—1·9% urea
First hour after ...	80 ,,	,, —2·6% ,,
Second hour after	115 ,,	,, —2·8% ,,
Third hour after ...	98 ,,	,, —3·1% ,,

(*b*) Pigment excretion (phenolsulphonphthalein): first hour, 50%; second hour, 14%; total 64%.

Intestinal absorption of glucose (22 grm. glucose = 1 grm. per kilo body-weight):—

Fasting blood-sugar	...	110 mgm. %
½ hour after	...	150 "
1 " "	...	169 "
1½ hours after	...	132 "
2 " "	...	110 "

During her residence the patient has been confined to bed, and has been given an ordinary full diet with the addition since 10.4.33 of viosterol (Mead's) min. x, t.d.s. Iron was withheld in order to observe the effect of vitamin D *per se*. The periodic blood-counts are shown below, as well as the result of periodic X-ray examination of the wrists before and after the institution of vitamin D therapy.

Blood: Differential count (Schilling):—

	Hb. %	R.B.C.	W.B.C.	Eosinos.	Basos.	Myelos.	Juv.	Stabs.	Seg.	Lymphos.	Monos.
6.4.33	33	3,010,000	9,000	3	—	—	3	14	41	33	6
20.4.33	28	2,600,000	22,000	13	2	1	4	17	45	16	2
1.5.33	38	3,800,000	12,000	4	—	—	4	12	49	28	2
13.5.33	40	3,900,000	15,000								
8.6.33	28	2,830,000	10,000	9	—	—	—	8	47	32	4

Wrists (see fig. 1):—

1.3.33	...	Active rickets	8.5.33	...	Healing definite
6.4.33	...	i.s.q.	19.5.33	...	? advanced healing
28.4.33	...	? healing	7.6.33	...	still more advanced healing (see fig. 2)

Chlorotic Type of Anæmia.—Leonard Findlay, M.D.

M. B., female, aged 11 years, came under observation on 6.8.31 with a history of lassitude, dyspnœa on exertion and increasing pallor of one month's duration. There is no history of any change in diet, dress, or environment before the onset of the illness.

She was a big, well-nourished, but very pale girl with a lemon tint of skin. Physical examination was negative except for a basal V.S. murmur and venous hum in the neck.

Examination of blood gave following result: Hb. 39%; R.B.C. 3,700,000; W.B.C. 5,000. Stained films showed ring staining of the red cells, variation in size (with large and small forms) but no nucleated varieties. Fragility of red cells normal.

Differential leucocyte count: Neut. polys. 60%; lymphos. 35%; transitionals 4%; basos. 1%.

Blaud's pills, gr. v t.i.d., were instituted on 14.8.31 and the following are blood-counts before and after this therapy.

	R.B.C.	Hb. %	W.B.C.	C.I.
7.8.31	3,700,000	39	5,000	0·62
13.8.31	3,500,000	38	...	0·63
20.8.31	3,600,000	45	...	0·66
27.8.31	3,900,000	55	...	0·78
7.9.31	4,500,000	62	...	0·73
17.9.31	4,800,000	74	...	0·74
28.10.31	4,750,000	80	...	1·0
16.1.32	4,800,000	80	...	1·0

"Pernicious" Blood Picture in an Infant, with Recovery.—T. Pearse Williams, M.D.

T. C. L., a male infant, aged four months, admitted to the Paddington Green Children's Hospital on 15.3.33.

History.—A healthy breast-fed infant until 5.3.33 when an attack of diarrhœa and vomiting developed. Breast-feeding changed two days after onset of illness to

a humanized dried milk. The diarrhœa lasted for four days and the vomiting for two only. Eight days before the loose motions appeared the infant had been vaccinated.

On 3.3.33 pallor was noticed by the parents and this increased up to the day of admission. At this time the weight was 14½ lb. and the only abnormal features were a marked degree of pallor and a spleen palpable one inch below the costal margin. The vaccine pock appeared to be quite healthy. The stool was healthy and did not contain occult blood; urine normal.

16.3.33.—R.B.C. 1,440,000; Hb. 28%; C.I. 1·0; W.B.C. 7,500. *Differential:* Polys. 31%; lymphos. 64%; large monos. 3%; eosinos. 5%; basos. 5%. There were 22 normoblasts and 10 megaloblasts in a count of 400 W.B.C. Abnormal forms: Some anisocytosis; some megalocytes; polychromasia in a few.

21.3.33.—Reticulocytes 14%-15%.

4.4.33.—R.B.C. 2,780,000; Hb. 50%; C.I. 0·9; W.B.C. 4,750. Reticulocytes 9%. A few poikilocytes, macrocytes, and microcytes; 8 normoblasts to 250 white cells.

24.4.33.—R.B.C. 3,150,000; Hb. 57%; C.I. 0·9; W.B.C. 7,500. Reticulocytes 6%-7%. No nucleated R.B.C. Slight anisocytosis and a few poikilocytes.

12.5.33.—R.B.C. 3,930,000; Hb. 68%; C.I. 0·87. Reticulocytes 3%; W.B.C. 8,500. A few poikilocytes and slight anisocytosis. No nucleated R.B.C.

There was a low irregular fever at first, with occasional vomiting. Fed for a few days on the humanized dried milk, then whole lactic acid milk with added karo syrup.

Drugs: Copper sulphate gr. 1/200, with iron and ammonium citrate, gr. x, four times a day; hepatex 2 c.c. for six doses.

The infant was kept out of doors as far as possible and made steady progress. The colour improved and the spleen receded.

Icterus Gravis Neonatorum.—J. C. HAWKSLEY, M.D., and REGINALD LIGHTWOOD, M.D. (by permission of ROBERT HUTCHISON, M.D.).

Patient, male, aged 21 days. *History.*—Pregnancy and labour normal. Birth, full time. Placenta, liquor amnii and vernix caseosa all normal. Slightly jaundiced at birth. The degree of icterus diminished at first and then increased. Stools and urine contain bile pigment, the latter from the third day.

Family history.—None of icterus gravis neonatorum. Patient is the second child; the first was healthy and not icteric at birth.

Clinical examination.—A well-nourished infant; somewhat drowsy. Central nervous, cardiovascular and respiratory systems normal. Abdomen: Liver enlarged two finger-breadths; spleen enlarged two and a half finger-breadths. Somewhat prominent veins in epigastric region.

Laboratory findings on twelfth day.—Van den Bergh reaction: Direct strongly positive; indirect test = 35 units of bilirubin. Urine and stools contain bile pigment.

Hæmatological data.—R.B.C. 1,400,000 per c.mm.; Hb. 30% (Haldane); C.I. 1·07; platelets 570,000 per c.mm. Reticulocytes 11·9%; nucleated red cells 6,600 per c.mm.; W.B.C. 33,000 per c.mm. *Differential*: Polys. 37%; lymphos. 52%; monos. 5·5%; eosinos. 1·5%; myelos. 0·5%; metamyelos. 3·5%.

Treatment.—Whole blood transfusion 100 c.c. given on May 19. Condition much improved.

On the day after the transfusion the blood-count was as follows:—

R.B.C. = 2,800,000; Hb. 58% (Haldane); C.I. 1·04; reticulocytes 13·5%; normoblasts 7,402 per c.mm.; megaloblasts 339 per c.mm.; W.B.C. 11,300 per c.mm.

Differential: Myeloblasts 0·5%; myelocytes 2·5%; polys. 30%; eosinos. 0·5%; basos. 1%; monos. 85·5%: lymphos. 57%.

The infant was discharged on 22.5.33, and the mother instructed to attend at frequent intervals for advice and further treatment if and when necessary.

The syndrome of icterus gravis and its relationship to other forms of anæmia in the new-born have been touched upon by Dr. Helen MacKay when describing her four cases. We have found treatment by whole blood transfusion more satisfactory than injection of serum. Transfusion must be adequate, and if necessary repeated at frequent intervals until the child's own erythropoiesis is keeping pace with the excessive hæmolysis. These cases are treated when possible as out-patients, to avoid any risk of ward infection, to which they rapidly succumb.

The recorded cases of icterus gravis show considerable variety in their manifestations. In a few cases the mother has herself been jaundiced at the end of each pregnancy in which a jaundiced infant has been born. These cases are exceptional. Other factors occur from time to time which increase the perplexity of the problem of ætiology.

Changes in the mean diameter of the red cells occur. At the earliest stages the mean diameter is greater than normal, but it diminishes more rapidly than is the case in normal infants, a phenomenon observed to a lesser degree in premature babies by Van Creveld. This is probably related to the excessive hæmolysis taking place both in the premature child and, to a much more marked degree, in cases of icterus gravis.

Histological Preparations from Cases of Icterus Gravis Neonatorum.—REGINALD LIGHTWOOD, M.D., and J. C. HAWKSLEY, M.D.

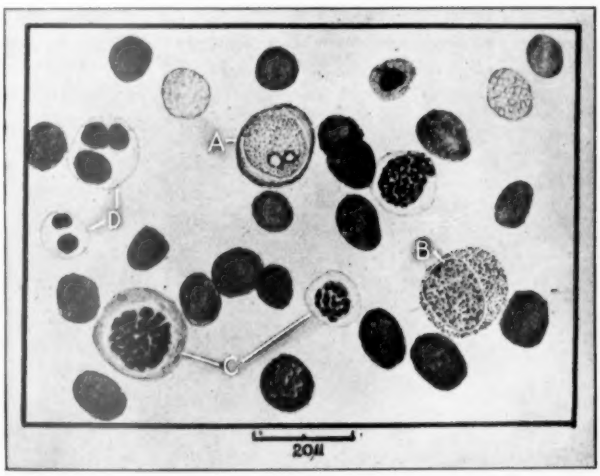
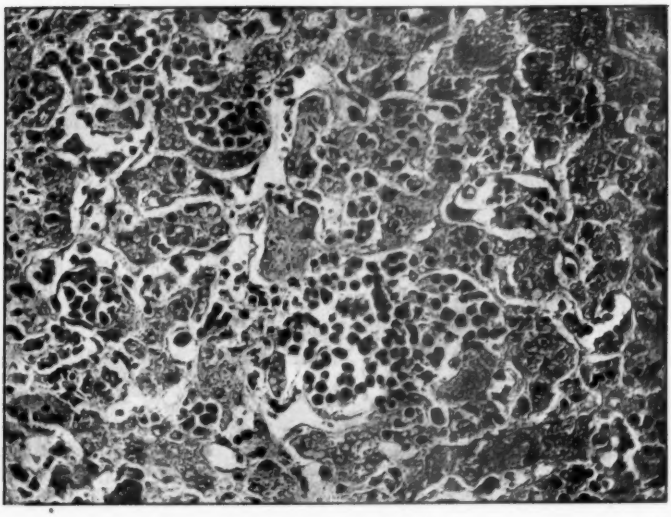


FIG. 1.

A, myeloblast. B, myelocyte. C, erythroblasts. D, normoblasts with fragmenting nuclei.

(1) Micro-drawing of a blood film from a case of icterus gravis neonatorum, showing normoblasts, megaloblasts and immature myeloid cells, in addition to the normal cells.



× 300

FIG. 2.

(2) Section of liver from a case of icterus gravis neonatorum, in which the patient died aged 36 hours, showing normoblasts and megaloblasts developing in the liver sinusoids, deposition of bile pigment, and degenerative changes in the liver cells.

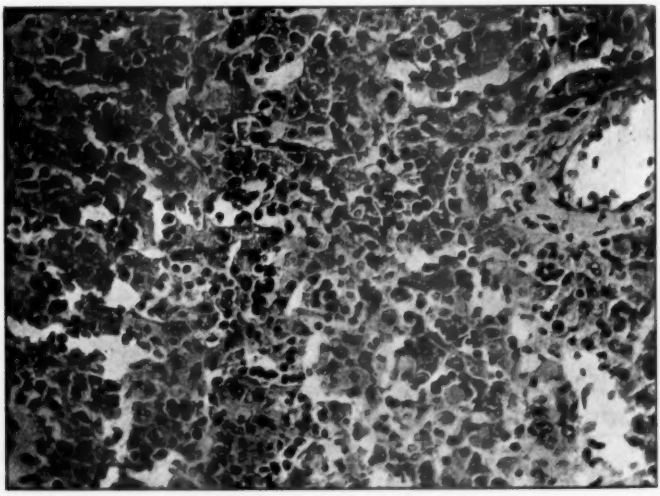


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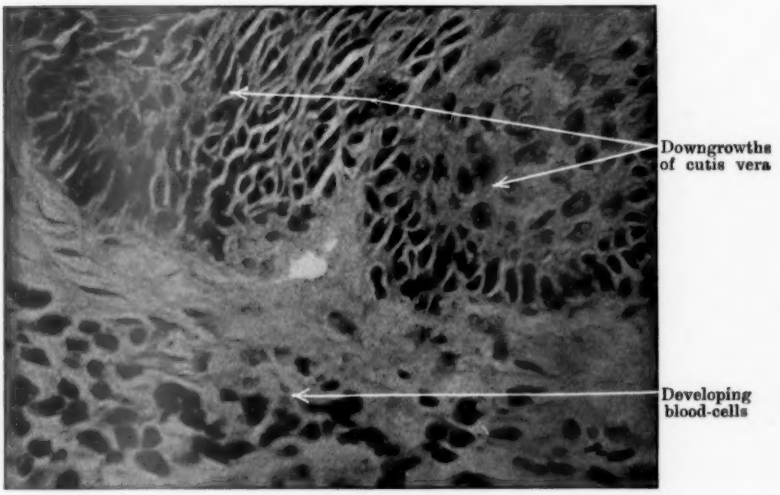
FIG. 3.

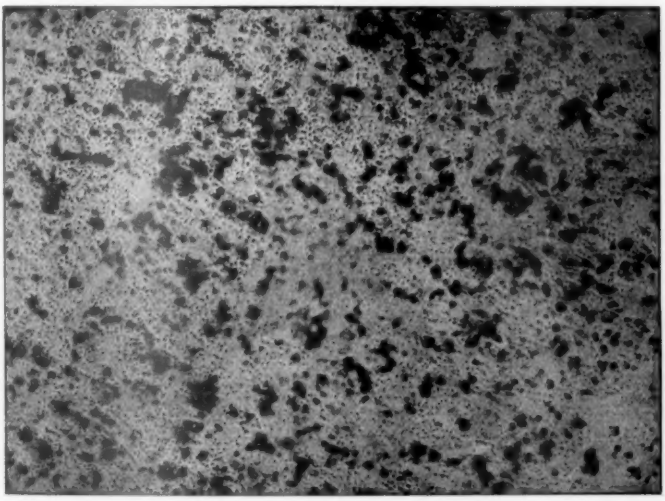
(3) Section of fœtal liver at twenty-three weeks' gestation showing the stage of intrahepatic erythropoiesis at this period, comparable to the degree of erythropoiesis seen in the last specimen (fig. 2).



× 650

FIG. 4.

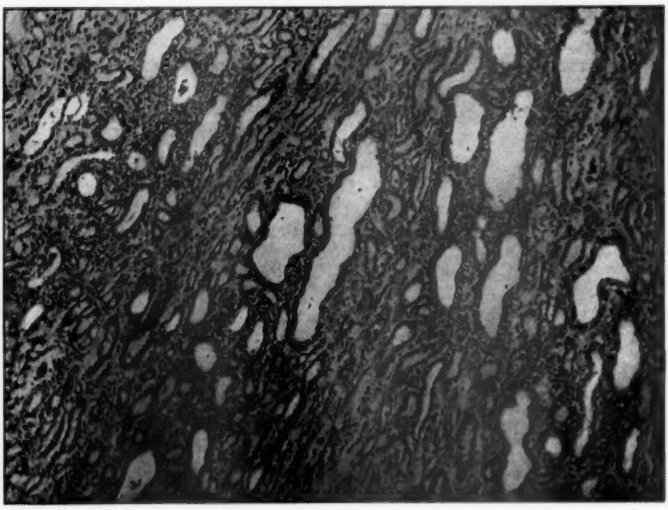
(4) Section of skin from a case of icterus gravis neonatorum, fatal at thirty-six hours, showing erythropoiesis in the connective tissue beneath the cutis vera.



× 75

FIG. 5.

(5) Section of spleen from a case of icterus gravis neonatorum, fatal at two months old, showing marked hæmosiderosis (black).



× 75

FIG. 6.

(6) Section of kidney from a case of icterus gravis neonatorum, fatal at 6 weeks old, which showed dilatation of renal tubules (? due to blockage by crystalline uric acid deposits) and erythropoiesis (oil immersion, $\frac{1}{12}$").

Summary.—These specimens are shown in illustration of the pathology of the group of diseases coming to be known under the group-name of fœtal erythroblastosis. Specimens taken from fatal cases dying at different ages show a diminishing degree of extramedullary erythropoiesis with increasing age and this can be correlated with the gradual disappearance of nucleated red-cells from the blood during the first three weeks after birth. Meanwhile deposition of bile pigment, and later hæmosiderosis, occurs in the liver and spleen. The liver cells show more or less degeneration.

Severe Anæmia in a New-born Child.—JEAN SMITH, M.D.

B. C., female child, aged 9 weeks. Was admitted to hospital on March 31, when ten days old. Nothing abnormal was noticed in the full-term healthy infant until the fifth day after birth, when she first appeared rather pale. This pallor gradually increased until the tenth day when she was admitted to hospital. There had been no excessive hæmorrhage at birth, nor any evidence of bleeding since then. For three days the stools had been loose and frequent.

When first seen, there was extreme pallor of the lips and conjunctivæ, and the skin was of a pale lemon colour. The respirations were deep and rapid (60), and the pulse small and running. The liver was not palpable, but the spleen extended about two finger-breadths below the costal margin.

Treatment.—A blood transfusion of 30 c.c. of the maternal grandmother's blood was given immediately on admission, and was followed by a second transfusion of 25 c.c. four hours later.

These transfusions resulted in a distinct improvement. On the second day intramuscular injections of 0·05 grm. collosal iron twice daily were begun and

continued for ten days, when the child was sent home on a mixture containing 6 gr. iron and ammonium citrate daily. The following table gives the blood-counts made at intervals on this infant :—

	31.3.33	8.4.33	11.4.33	24.4.33	8.5.33	25.5.33
R.B.C. ...	800,000	1,630,000	2,100,000	3,510,000	3,350,000	4,354,000
Hb.% ...	18	30	40	44	45	76
C.I.	0·95	0·9	0·99	0·7	0·7	0·8
W.B.C. ...	11,600	13,600	5,200	19,400	8.000	...
Polymorphs. ...	18·0	23·0	44·0	64·5	30·0	...
Eosinophils ...	3·0	5·0	2·0	2·5	3·0	...
Myelocytes ...	26·0	15·0	8·0	3·0	13·0	...
Myeloblasts ...	22·0	2·0	0·4	...	...	...
Leucoblasts ...	3·0	...	...	...	...	...
Hyalines ...	3·0	3·0	4·4	3·0	3·0	...
Lymphocytes ...	27·0	53·0	39·0	27·5	51	...
Basophils ...	1·0	...	0·8	...	...	...
Anisocytosis ...	+++	+++	+++	++	++	...
Poikilocytosis ...	+++	+++	+++	++	++	...
Polychromasia	+++	++	++	++	+	...
	39,440 nucleated r.b.c. per c.mm. of which 97·0% are normo- and 3% megaloblasts	394 nucleated r.b.c. per c.mm. of which 13·5% are megaloblasts		No nucleated r.b.c. seen		

Fragility normal
Van den Bergh normal

The parents of this child are not related in any way.

Megalodactyly. ? Cause.—E. C. WARNER, M.D.

Patricia B., aged 11 years. The present condition has dated from the age of 2 years.

FIG. 1.

The gross enlargement of some of the digits on the hands and feet contrasts with the normal size of the intervening digits (fig. 1). The enlargement appears to involve

the bones, especially at the non-epiphyseal ends. In the winter-time especially, the affected fingers become very cold and blue, and cutaneous sores occur, the remains of which are evident as scars. There is no family tendency to gout: Blood uric acid, 3·6 mgm.% ; blood-pressure 150/105. Wassermann reaction in blood negative ; blood-calcium normal. A biopsy shows the fibrous tissue which comprises the swellings, and no murexide reaction was obtained.

FIG. 2

Radiological report (Dr. A. Dixon).—"The bones of the fingers and toes show abnormal growth (fig. 2). Bone striation normal, no arthritis. Not one of the enlargements occurs at the epiphysial ends of the bones. All long bones and skull normal."

Dr. F. PARKES WEBER said that he regarded the case as an example of true ("primary") *gigantism* of one or more fingers or toes. What he (Dr. Weber) called *true gigantism* differed from all other hypertrophies, often loosely called gigantism, in the following points:—(1) the increase of growth was usually limited to one or more fingers or toes; (2) it was not symmetrical on the two sides of the body; (3) it was accompanied by great deformity in the shape of the overgrown part; (4) the increase in the size of the affected part was usually much greater than in any other kind of hypertrophy. Acromegalic "gigantism," for instance, was relatively much less in degree; it was more or less symmetrical, and was not primary, but was secondary to eosinophilic hyperpituitarism. The only treatment for true ("primary") gigantism of a finger or toe was surgical, that is to say amputation, if considered really advantageous. No endocrinological explanation could account for the asymmetry, the degree of overgrowth, and the deformity in shape of the affected part, in cases of true "primary" gigantism of fingers and toes. Whether the "urge" to the "primary" gigantism was really primary and local, or was of nervous origin was another question.

Anæmia: probably Acholuric Jaundice.—E. C. WARNER, M.D.

Olive F., aged 5. No family history of anæmia or jaundice. Van den Bergh and Wassermann reactions of mother negative.

When seen a year ago, said always to have been anæmic. Her spleen reaches 1½ in. below the umbilicus, and her liver is slightly enlarged. At times her skin becomes more lemon-yellow than at others.

Blood-count, May, 1932: Hb. 38%; R.B.C. 3,460,000; C.I. 0·56; W.B.C. 6,800 (polys. 53%; lymphos. 44%; large hyals. 2%; eosinos. 1%). Red cells showed marked anisocytosis and many megaloblasts. Van den Bergh (indirect) 2·0 units. Fragility of red cells 0·40%-0·30%. The highest hæmoglobin value during the last twelve months is 56%. In spite of liver extract equivalent to 8 oz. liver + ventriculin gr. 10 + ferri et ammon. cit. gr. 60 a day for the past six months, her blood-count now shows: Hb. 40%; R.B.C. 3,740,000. Van den Bergh 2·0 units (indirect). Thyroid extract produced no appreciable rise in hæmoglobin. Test meal: Hypochlorhydria; mean diameter of red cells before treatment 6·42 μ.

Acquired Acholuric Jaundice, with acquired Fragility of Red Cells.—E. C. WARNER, M.D.

Grace B., aged 11 years.

The father and mother have no splenic enlargement, jaundice, or increased red cell fragility: and no excess bilirubin in the blood. Since the age of 1½ years the patient has had attacks of sudden hæmolysis, with severe anæmia, jaundice and pyrexia, so that in the course of two or three days the hæmoglobin has dropped to under 20%, and transfusions have had to be given. In the attacks the spleen has enlarged, and has afterwards become smaller again. In an attack at the age of 3½ years when she was admitted to hospital under Dr. Harold Pritchard, the spleen reached to the umbilical level, and a month later had receded to the costal margin. In subsequent attacks the spleen has become progressively more permanently enlarged, so that it was constantly at the umbilical level. In an attack (March, 1930) a typical blood-count showed hæmoglobin less than 20%; red cells 1,210,000; white cells 5,600 (polys. 45%; lymphos. 47%; large hyals. 8%); no abnormal red or white cells seen.

Other investigations.—Fractional test meal, normal. Average red cell diameter 6·72 μ (April, 1930); red cell fragility normal in 1927; in March 1930, hæmolysis commenced in 0·50% saline solution and complete in 0·35%, as compared with a normal control with figures of 0·45—0·35%, and in February, 1933, the red cells hæmolysed in 0·70% saline solution, and hæmolysis was nearly complete in 0·55% saline solution. Even between the attacks of hæmolysis the van den Bergh test gave gradually higher values up to 6·0 units indirect, and the reticulocyte count remained at 7%. The blood-platelets were only 57,000. Splenectomy was performed by Mr. R. C. B. Ledlie, May 10, 1933, and on May 22, the hæmoglobin was 78%; red cells 3,640,000, white cells 5,000; indirect van den Bergh 2·0 units. (The spleen is also shown.)

Influenzal Meningitis.—T. STANLEY RODGERS, M.B.

L. P., male, aged 2 years, was admitted to the Staines Cottage Hospital, April 19, 1933, having suffered for a week with fever and vomiting. During the next fortnight the fever continued, and lumbar puncture, which was performed five times, showed a turbid fluid, under pressure, in which was found a bacillus of the influenza group.

On May 4 the child was admitted to the Westminster Hospital. He showed some wasting, marked irritability, slight hydrocephalus, and some stiffness of the

neck. Since admission, nearly three weeks ago, the general condition has improved somewhat, but the hydrocephalus and neck rigidity persist. A week after admission he had a right-sided Jacksonian fit, which has left him with a right hemiplegia. From the cerebrospinal fluid, which is still somewhat turbid with pus cells, and under increased pressure, was isolated a hæmophilic bacillus of the influenza group, Gram-negative, pleomorphic, with long filamentous forms. The bacillus grew well on Bordet-Gengou medium and, in primary culture, on blood-agar and very slightly on blood-serum. It was pathogenic to guinea-pigs and mice.

Cerebrospinal fluid.—Spontaneous "cob-web" coagulum on standing. Cells 200-900 per c.mm. mostly polymorphonuclears. Chlorides 700-730 mgm. per 100 c.c. Total protein 0·1% to 0·2%. No reduction of Fehling's solution.

Section of Odontology and Section of History of Medicine.

JOINT MEETING HELD ON APRIL 24, 1933.

Chairman—Mr. A. E. ROWLETT (President of the Section of Odontology).

The Sun, the Toothdrawer and the Saint.

By LILIAN LINDSAY, L.D.S.Edin.

(The C. E. Wallis Memorial Lecture).

IT is my first duty to speak of the man in whose memory this lectureship has been founded. Mr. C. E. Wallis used to sit next to me at the meetings of the History of Medicine Section of this Society; an interest in the history of dentistry formed a bond of sympathy between us. He did me the honour of asking me to read a paper on eighteenth century dentistry during his year of office as President of the School Dentists' Section of the Society of Medical Officers of Health. Mr. Wallis was a man of wide reading and retentive memory, a man of many interests, chief among which was an interest in child-welfare which found expression in his work as school dentist. In 1908 he put forward a plea for the institution of school dental clinics as the only way in which to deal with the condition of the teeth of the children in the elementary schools. He was one of the first school dentists to be appointed and was the first dentist to be appointed assistant medical officer under the London County Council. His retentive memory provided material for his entertainment of children whom he delighted with his stories and recitations. He wrote many articles on the history of dentistry, and at the time of his death was engaged in writing a history of Harley Street. At the Seventh International Dental Congress in Philadelphia, in 1926, he read a paper on his reminiscences as a clerk under Lord Lister at his old hospital, King's College, where he died. No better way of keeping his memory green could have been devised than this lectureship on the history of dentistry.

I have divided my subjects into three parts: (i) the sun, (ii) the toothdrawer and (iii) the saint. Naturally the sun predominates over the whole and is the longest part.

> ". . . . . when with one virtuous touch
> The arch-chymic sun, so far from us remote,
> Produces, with terrestial humour mixed,
> Here in the dark so many precious things
> Of colour glorious and effect so rare."

It is a fascinating occupation to endeavour to unravel the knotted skein of the distant past, and in the struggle to accomplish such a task it is as well to bear in mind that the paleolithic age, that longest period in man's history, was a vast one, and that the ideas and speculations which arose and remained at a fixed level during that great stretch of centuries must have made an indelible impression upon those cells of the brain in which inherited memory is located, and that this may account for the otherwise inexplicable superstitions with regard to the teeth and the treatment of their diseases and the prejudice, often subconscious, against the operator upon them. I shall show, by examples from literature, ancient materia medica, folklore and hagiology, that such a hypothesis is not untenable. The indestructibility of the teeth was perhaps the first anatomical observation. Their persistence after the disintegration of the rest of the body and the destruction of such vital organs as the heart, the brain and the liver, must have inspired those

early observers with awe and a conviction that the teeth were immortal and by an association of ideas, connected with the sun, that symbol of vitality and immortality. Just as such plants as the evergreens, which appear to be indestructible and everlasting, are bound up with sun-worship, so it was with the teeth, those organs which primitive man guarded with such reverence as the most vital parts of his being. When it is remembered that the teeth were believed to contain a supernatural force conferring upon their owner all that is most valuable in life, the reason is understood why, in the earliest codes of laws, such severe penalties were exacted from the person who, by accident or design, deprived another of his teeth.

Marcel Baudouin has studied this early connection between the teeth and the sun for many years. He has found them, strung into circles, or orientated unmistakably, in the entrance to prehistoric graves, and he believes that just as we invest our kings, mayors and presidents with chains of office, so early man hung chains of teeth round the necks of his rulers or chiefs as a sign of power, and he suggests that the necklaces of teeth worn to-day by primitive chiefs have this same significance underlying them.

Not only as necklaces, do teeth form part of the regalia of kings for, at the present day in Africa, when the Jaga King of Angola dies, a tooth is extracted from his head and placed in a box containing those similarly removed from all his dead predecessors, and only the man possessing the box containing those teeth can prove his right to the throne. In the Fiji Islands, the first ceremony in the coronation of the king is to hang strings of whale's teeth round the arm of the king to be crowned to the number of four or five hundred. These teeth are stained with turmeric and polished with cocoanut oil until they shine a bright golden. One of these teeth was presented to our Queen at the recent opening of the British Industries Fair, as a mark of respect and honour. The part assigned to teeth in these coronation ceremonies, proves their primal importance. Sir Arthur Evans, in his book on Mycenæan "Tree and Pillar Worship," says that early man did not regard the objects of his worship merely as symbols but as actually the god himself, and this is borne out by the story of that tooth in Kandy, in Ceylon. When the British captured it in 1820, they were told that as a result of its possession they would rule over four kingdoms. It was necessary to place a military guard over the shrine, not for its intrinsic value, encrusted though it is with gold and priceless jewels, but because the contention is fierce for the possession of the tooth enshrined there. It is the most sacred thing, a Paladium. The Tamils hold that it is the tooth of Hanuman, the monkey god, while Buddhists insist that it is the upper left canine tooth of Buddha, extracted at his death in 530 B.C. by his disciple, Khémo Théro, who took it to the town of Kalinga, which was thenceforth known as Danthapura, the town of the tooth. (I would like to interpolate here that the shape of the canine tooth might suggest the conventional outline of the flames round the corona of the sun, the petals of the lotus and the pæony.) The more recent story of that tooth does not concern us but its ancient story, found inscribed upon a pillar in Pali verse and translated by Turnour in 1836, is illuminating in more senses than one. It runs that in that town of Danthapura, there arose a devout ruler, Gu'Hasi'Wo, who revived the worship of the tooth and expelled from his town the heretic Brahmins. These complained to the Emperor Pandu, "Gu'Hasi'Wo worships a human bone." The Emperor sent an army to demand the surrender of the tooth. Gu'Hasi'Wo, placing it on his head amid the tears of his people, mounted a golden chariot "resplendent as the rising sun," drawn by milk-white horses and went in procession to the Emperor. All along the route the people brought gold, precious stones, costly apparel and sweet-smelling flowers as offerings to the tooth as it passed. The Emperor, in a rage, ordered the tooth to be thrown into a charcoal brazier. Out of the brazier, arose a lotus (the symbol of vitality), large as a chariot wheel, in the heart of which glowed the tooth. The people bowed down before it, murmuring

for the first time, "om, mane, padme, hum," "lo! joy is in the lotus." It was ordered to be pounded on an iron anvil, but the tooth, sinking half-way into the anvil, "shone like the sun rising behind the mountain of the morn," and defied all efforts at its extraction until a devout character, reciting all the miracles and incarnations of Buddha before it, prevailed upon it to leave the anvil and ascend aloft. Then "descending from its aerial altar" it alighted upon the head of the devout character, conferring much happiness upon him. He placed it in a golden bowl "of delightfully pure water, round which the tooth travelled in circles and always to the right." It was ordered to be flung into the sewer into which all the filth of the town collected. This became immediately "pure as a pond in the Nanda heaven." Golden flowers grew up, round which the tooth circled, shedding such effulgence that the whole town seemed as if bathed in an ocean of milk. The State elephants roared, the horses neighed, the people sent up shouts of joy, and the Emperor was converted. He went down to the sewer and apologized to the tooth which showed its forgiveness by soaring up on to his head, making a halo round it "like splashes of milk." The more recent story of this tooth, as I said, does not concern us. It involved fierce wars, the outpouring of blood and treasure, and the perpetration of much fraud. It arrived in Kandy, in Ceylon, concealed in the hair of the Princess He'ma'ma'la, whose husband Danta'kumaro was made the first custodian of the tooth, an office which exists even to-day. But this other story bears in it marks of an extreme antiquity, far older than the death of Buddha and must convince all who hear it that this tooth was worshipped as the sun himself.

The golden chariot and the white horses, the travelling round in circles and to the right, the purifying and creative properties, the joy of animals, plants and man in its presence, and its conference of the right to rule and the fact that in that shrine in Kandy, the light of day is not allowed to enter as the tooth is the light of the shrine. The allusion to the ocean of milk is a link in the chain between the teeth and the idea of immortality, for it was out of the ocean of milk that the Indian god of healing, Danvantari, rose holding in his hand Amrita the cup of immortality to cure all human ills. (I am tempted to suggest that this might be prophetic when the latest idea on the prevention of caries is considered.)

The man with white, regular, intact teeth was marked out by such teeth as a ruler of men, which would seem to imply that such a set of teeth was as much an ideal in those days as it is now. This is borne out by stories from all parts of the world.

In the Popol Vuh, there is the story of the King, Vukub Cakix, who became proud. He boasted "my teeth shine in their enamel like the face of heaven." Two youths resolved to lower his pride and shot at him with their blow-pipes, hitting him in the jaw, and persuaded an aged couple to finish their work by the extraction of the king's teeth. These old people, whose business it is to extract worms from the teeth, go to the palace and tell the king they can relieve the pain in his jaw by the extraction of his teeth and he says, "Is it good that I should lose my teeth, for it is only thus that I am king." They tell him they will replace them with others and, as often happens, even to-day, the operation was not a success. They extracted his teeth and replaced them with white maize grains which could be seen shining in his mouth but he ceased to appear a king, his pride was completely taken away, and he died.

In the Mahe' Wanso', the ancient historical writings of Ceylon, 2,500 years old, there is the story of Chanakko, who was a forerunner of Pasteur. When a youth, he found his mother weeping, and on asking her the cause, discovered that it was because he would rule over everyone and forget his mother, and he asks on what part of his body this power is indicated. She replies in surprise, "My dear, on thy teeth." At once he smashed his teeth and became Kandadattho, the tooth-broken man, and was for ever afterwards celebrated for his devotion to his mother, so much so that he used her in his experiments in immunity to poisons.

The reverence with which teeth were regarded is shown by their use as seals to important documents right down into historical times. In Dashwood's Sigilla Antiqua, there is an illustration of such a seal. "The impression of the teeth in wax of Agnes, the daughter of Agnes, the daughter of William Fitz of Fyncham to a deed by which she enfeoffs Adam de Fyncham in one acre and three roods there," and there is a contemporary rhyme,

"In proof that this is sooth,
I bite the wax with my wang tooth."

This shows that teeth were used in the confirmation of oaths just as we use the Gospels to-day.

The supernatural power dwelling in the teeth is shown by the ceremony, at the initiation into manhood and womanhood in various primitive tribes in different parts of the world, where the front teeth are knocked out. Among the aborigines of Australia in some tribes this is compulsory, in others it is voluntary, but where it is voluntary, there is an alternative and that is circumcision. Dr. Campbell, who has written on the teeth and palate of the Australian aborigines, finds this alternative difficult to explain, but it is perfectly obvious that at such a solemn period of life, something of the utmost vital importance has to be sacrificed.

Elaborate ablutions must be performed before the ceremony. The neophyte lies on the ground, the mouth is filled with fur fibre, to prevent the teeth from being swallowed, a thin piece of wood is forced down between the tooth and that on either side of it to free it from the gum and to break down the inter-dental septum, a sharp-pointed piece of wood is placed against the tooth and a blow given to it at the other end with a heavy stone, and the tooth is knocked out. This piece of wood is the counterpart of the instrument for the surgical removal of teeth described in a Saxon manuscript as "a piece of wood shaped like a hedge stake." After the teeth are knocked out, further rites must be performed purporting to remove the life from the tooth. If this were not done and an enemy or even a friend got hold of that tooth, they would have unlimited power over its former possessor, not only in this life, but in the next. This is shown by the story told by Professor von Brenner, who travelled among the cannibals of Sumatra in 1893, when he met the Chief Si Gallak, who had an inordinate love of gold. His teeth were covered with gold; he wore an elaborate gold chain round his neck, from which depended a bamboo snuff box, in the lid of which was stuck the canine tooth of his most hated enemy, and every time he opened and shut that box he struck the tooth with his fist, imagining that he was still inflicting blows upon an enemy whom he had killed and eaten some time before.

The loss of teeth, loose teeth, decayed teeth, indicate weakness, the approach of age and death. Anything that would bring this to pass would be regarded as an arch enemy, and the enemy of the sun is the darkness personified by the serpent or the worm.

In the Babylonian legends, Tiamât the Worm is the enemy of the Sun God, and in the earliest toothache charm in existence, inscribed on the Babylonian brick in the British Museum, Tiamât comes weeping to Samas the Sun God asking to be put amid the teeth "that I may destroy the blood of the teeth and of the gums chew their marrow." Unfortunately Tiamât gives herself away by saying, "Then shall I hold the latch of the door; that is, conquer and hold in prison the sun-god.

Samas says, "Because thou hast said this O Worm, may Ea smite thee with his mighty fist." A conclave is held in heaven and Mardûk is ordered to hack the body of Tiamât in pieces and this is shown upon another brick. Mardûk armed himself, filled his body with fire, leaped upon the body of Tiamât and smashed her head.

Now, the tooth has passed from being the sun to being under the protection of the sun and as might be expected, all the early toothache remedies are those connected

with sun worship. The remedy for toothache among the ancient Egyptians was to split the body of a living mouse in half, and lay it while still warm along the gums of the sufferer. This sounds a repulsive remedy, but Professor Elliot Smith says that the Egyptians regarded the mouse as an antidote to death, and accounts for this by the fact that, after the subsidence of an inundation of the Nile, swarms of mice appear in the Nile mud, from which the Egyptians would conjecture that the sun had created them there and that they were his peculiar creatures. One of the titles of Apollo was Smintheus, the mouse god, and in his temple at Troad, an image of a mouse was placed beside his tripod. Another of Apollo's titles was Saurochthonus, the lizard god; the statue in the Louvre shows Apollo under this guise. Among the gypsies of the East there is a toothache remedy, "the lungs of mice pounded and mixed with the livers of lizards"—that is Smintheus and Saurochthonus in the one toothache remedy.

The ancient Greeks pounded the body of a freshly killed mouse, mixed it with powdered marble and put it in the hollow tooth.

In parts of Bohemia, the heads of living mice are bitten off and strung into necklaces to hang round the necks of teething infants to prevent convulsions; of course, Apollo was invoked for convulsions, the falling sickness and insanity.

In ancient Mexico, just as in this country and parts of Germany, children dropped their cast teeth into mouse holes, saying, "Mouse, mouse, give me your iron tooth and I will give you my bone tooth." Everyone must be familiar with the custom of dropping children's shed teeth into the fire, a relic of sun worship. In parts of Lancashire not only the shed teeth of children but those of adults whether shed or extracted must be put into the fire by their owner, or they will have to look for that tooth after death in a pail of blood in hell. The Arabs are more direct; they throw cast teeth towards the sun.

The plant remedies are just as significant, and the first of these is the pæony, as its name suggests from Pæon, Apollo, the healer, who used it to staunch the wounds of Pluto after his combat with Hercules. Pliny says, "it is good for the falling sickness and the incubus," and Diodorus Sicculus says, "it shines in the night as a light fat or lamp and is gathered by herdsmen at night," and Gerarde, the herbalist, says, "it is a herb of the sun under the lion. It is called Ideus Dactylus which agreeth with the female Peonie the knobbie roots of which be like Dactyli Idæi and Dactyli Idæi are certaine precious stones of the forme of a man's finger growing in the Iland of Candie. It is called of divers Aglaophotis or Brightly Shining, taking his name from the shining and glittering graines, which are of the colour of scarlet." The roots of pæonia peregrina certainly suggest gouty fingers and may be the origin of the German name for this plant, "Gichtrosen," gouty roses. The root of *Pæonia officinalis* has a distinct resemblance to teeth. This plant is mentioned in the last edition of Martindale and Westcott.

The seeds of the pæony are light red when fresh but get darker as they are kept; they resemble rubies or garnets, and these resemblances were probably the origin of the description taken from some Eastern document, handed down and copied repeatedly—its meaning becoming confused in the process—the allusion might be to Kandy, in Ceylon, and it is interesting to compare these sentences of Gerarde's with the various derivations of the name of Ceylon: from Sinhala, "the lion descended"; Tambia pani, "the great pond of red lotus" (the shining and glittering graines which are of the colour of scarlet) and Pao-chu, "Isle of Gems" (certain precious stones growing in the Iland of Candie). Nevertheless, it must not be forgotten that the other name for Crete was Candia, and associated with the Oracle (which told Teucer to settle wherever "the earth born ones" attacked him) with Smintheus (the Cretan word for a mouse), and with the nymph, Idæa. Culpepper says it is a herb of the sun under the lion and that it is good to cut the roots into slices and make them into necklaces to hang round the necks of teething infants to

prevent convulsions. Hooper, as late as 1830, says in his medical dictionary that it is corroborant and the root has been used since the days of Galen, worn as an amulet, not only to prevent convulsions in infants but in epilepsy, and quotes a case reported by Home of an epileptic in the Edinburgh Infirmary who received benefit from such a necklace; he adds wistfully that modern writers find it of little use.

All those anodyne necklaces for teething infants so freely advertised in the eighteenth and early nineteenth centuries were made of pæony roots and indeed, in parts of the country to-day, mother's make such necklaces to hang round their children's necks in the fond belief that they will thereby prevent convulsions.

The next plant is the ivy. About twenty years ago, Mr. Foran, who belongs to an old Guernsey family, told me that in that island there was a chapel of St. Paul where the inhabitants go to pick the ivy leaves growing on the walls to chew for the relief of toothache. In Diodorus Sicculus, there is the story of Osiris who went on a civilizing journey through Egypt, taking with him his brother Apollo, and on that journey Osiris discovered the ivy and Apollo the laurel. Among the ancient Greeks, the ivy and the laurel were used as male and female fire sticks. Diodorus proceeds to say that in the Egyptian language the ivy is called Osiris plant, "and they esteem it above the vine in all their sacrifices for the vine loses its leaves and the ivy always continues fresh and green," that is, the evergreen plant prevails over the deciduous one, and that is the reason why the ivy has always been considered as an antidote to drunkenness. John Arderne, the surgeon of Newark, who went with Edward III on his French campaigns, says, "Let the tooth you want to remove be rubbed with the gum of ivy and it will immediately fall out," and Gerarde says, "The berries of ivy beaten small and made hot and dropped into the contrary ear easeth the toothache."

The last plant, the henbane or hyoscyamus, is very interesting because it combines in it the idea of the god and the worm. The old stories of the gods were very confused, Apollo appearing often as the serpent. It was as the serpent that he was the father of Æsculapius and as the serpent was father to the Emperor Augustus. Scribonius Largus, physician to the Emperor Claudius, who is supposed to have visited this country with him in A.D. 43, is accused of being the originator of the henbane fraud, but he was nothing of the kind; he merely says in his materia medica that if the seeds of hyoscyamus are sprinkled on hot coals and the vapour inhaled, the toothache will be eased and that if the mouth is rinsed out afterwards sometimes as it were small wormlike bodies are expelled. He does not say that these are the worms that have been gnawing the teeth and causing the pain, for he used the expression, "quasi vermiculi." But the quack, always on the outlook for a means whereby he could exploit a gullible public, seized upon the idea and made capital out of it through the centuries.

There were, however, honest people who knew that the vapour of hyoscyamus was an anodyne and used it in this way. In the Regimen Sanitatis Salernitanum, there is this rhyme, translated by Sir Kenelm Digby, in the seventeenth century:—

> "If in your teeth you hap to be tormented
> By meane some little worm therein to breed
> This pain if heed be ta'en may be prevented
> By keeping clean your teeth whenas you feed
> Take Francomsense, a gum not evil scented
> Put henbane unto this and onion seed
> And with a tunnel to the tooth that's hollow
> Convey the smoke thereof and ease shall follow"

An advertisement on the cover of an early edition of one of Dickens' novels illustrates this rhyme and shows at what a late date this remedy was used, and

indeed, in parts of the country to-day, it is still used. Gerarde says it is a herb of the sun under the lion and is called by the Latins "Apollinaris," belonging to Apollo, or "faba jovis," Jove's bean, but Culpepper asks how can it be a herb of the sun when Dr. Reason tells him it must be a herb of Saturn for "ne'er a stinking ditch but it growing by it"! !

Those who were born under the sun and the lion, had certain privileges and certain disabilities, for in a French astrological work of the seventeenth century we learn that those so born would enjoy the smiles of the great, high office and good emoluments; but they would be subject to quartan fever, headache, toothache and insanity, and be in danger of fire. It almost seems as if the god were unmindful of his own.

THE TOOTHDRAWER.

After what has been said of the divine nature of the tooth, it will not seem strange that the operator should have been so despised that his ranks could only be recruited from the lowest grades of society and a further consideration into the origin of the calling will reveal the reason for this antipathy to one who, like the Amalekite in the story of Saul, "would stretch forth his hand to destroy the Lord's Anointed."

Mr. Warren Dawson has pointed out that the attendant who made the first incision into the corpse in the ritual of mummification was driven away with missiles and objurgations and the same hard hap may have befallen the earlier toothdrawer, in spite of Cicero's assertion that the inventor of toothdrawing was the third Æsculapius. This too, may account for that leaden pair of forceps in the temple of Apollo at Delphi, which has been the subject of age-long conjecture. Some authorities state that it was placed there as a warning not to extract any tooth until it was loose enough to be extracted with an instrument made of lead. Professor Sambon says it was placed there as a votive offering by an early toothdrawer, and that seems the most feasible explanation—as a votive offering in expiation of the crime of sacrilege. Diodorous Sicculus says, "We know that Apollo first invented methodien, that is, the irons." The original meaning of these votive offerings seems to have been as symbols of the god in which case the symbol of Apollo would be a pair of forceps.

The surgeon like the toothdrawer was a shedder of blood and Thomas Gale, writing in the sixteenth century, says of surgery, "Few that have well brought up their son will put him to the art it is now so beggarly and vile." In 1163, Pope Alexander III forbade the clergy to interfere in matters of surgery or to engage in any work which involved the shedding of blood, and it may have been a combination of these prohibitions with the added fear of the man who would deprive another of his vitality or even of his immortality, which bred a distrust of the toothdrawer in the mind of the people. Just as the office of the executioner or hangman is so abhorred that few self-respecting citizens will think of entering such a walk in life, so it must have been with the early toothdrawer, who was often called upon to extract teeth as a punishment for crime. The carver of the miserere seats in Ely Cathedral had this in his mind when he depicted his contemporary, the toothdrawer with a cloven hoof.

Apart from that oft-quoted passage in Herodotus, showing that there were specialists for the teeth in ancient Egypt, and the mention by Martial in one of his satires of Cascellius as an extractor of aching teeth in Rome, there is little to suggest that toothdrawers were numerous in the early centuries. That diseases of the teeth existed is obvious, but the first mention of such a calling as toothdrawing, apart from barbery and surgery, is to be found in the fourteenth century work of Guy de Chauliac, in which he speaks of "dentatores" and that when a tooth has to be extracted a toothdrawer must be called in. These are practically the same words as those used by Wiseman in the seventeenth century, who was very likely copying from Guy de Chauliac, when he says, "When a tooth has to be dislocated a toothdrawer must be consulted."

One of the earliest representations of a toothdrawer is the one in the fourteenth century manuscript in the British Museum, mentioned by Ashley Densham in 1909 and shown by Sir D'Arcy Power at the Jubilee meeting of the British Dental Association in 1930. It shows a toothdrawer with an enormous pair of forceps to which he is applying both hands, but his most conspicuous feature is his necklace of teeth. Did he wear it as a relic of ancient mysticism? Sir James Frazer says that the wreaths of laurel worn by the victors in the Pythian games were originally worn as amulets, as protection against the pollution of blood. It will be remembered that after Apollo slew the python in the gorge at Delphi, he fled to the vale of Tempe, where he remained until cleansed from the pollution of the python's blood. These wreaths, originally amulets, came to be marks of honour and victory, and I suggest that the reverse process took place with the necklaces of teeth, originally insignia of office, they came to be used as amulets by the toothdrawer as a protection against the pollution of blood; finally, as parts of a costume, without any reference to their meaning, which had been lost in the transit through the ages. Just as he wore in his cap the leaden image of a saint in the form of a brooch which had been discarded by some pilgrim who had obtained it as a token that his pilgrimage to the shrine of that saint had been performed, it is difficult to say. The meaning of his monkey too, must be left to somewhat lively conjecture. Monkeys have a good deal to do with the teeth. I have already alluded to that tooth in Kandy as the tooth of Hanuman, the monkey god, worshipped by the Tamils who were devotees of Vishnu, one of whose impersonations was as Kapi, the monkey who spills or produces rain. Teeth were and are used as rain charms. Among the aborigines of Australia where drought is prolonged sometimes for years, a victim is chosen, all his teeth are knocked out of his head, so that his mouth with its dark empty interior may resemble the dark rain cloud—a piece of sympathetic magic—in other words, the sky, deprived of its sun.

In the Saxon "Leechdoms, Starcraft and Wortcunning," there is a passage which is the origin of this investigation of mine, "The teeth which the Greeks call organon, which in our language is bliss, since through the teeth the bliss shall upspring and man's dignity and all necessity is on the teeth." Skeat, the etymologist, says that this word bliss occurs in the contemporary sacred writings, the Heliand or Saxon Gospels, in connection with the sky, and is allied to blican, to shine; so that the sentence in modern language would be "the teeth which are our *shining ones* or *our sun*." And Kapi, the monkey who spills or produces rain, is the monkey who deprives the sky of its sun, or extracts the teeth from the mouth. The earliest illustration of the operation of extraction shows monkeys extracting the upper left canine tooth from a giant. This is a carving on the ancient stupa at Barut, near Allahabad in India, built between 300 and 200 B.C., over one of the eight relics of Buddha. A seventeenth century German print shows monkeys extracting teeth in the market place, and the toothdrawer is shown with his constant companion, the monkey.

The first mention of toothdrawers in our literature is to be found in "The Vision of Piers Plowman" in the part concerned with the Seven Deadly Sins. Gloton is on his way to Mass and is enticed into a tavern by a brewster, where he takes part in a disreputable brawl with "porters, pickpurses and piled toothdrawers." In all the children's books of the period, the toothdrawer is a familiar everyday figure, and in that curious fragment, Cock Lorel's Bote, Cock Lorel, as his name suggests, was the chief rogue and he wandered up and down the country with a band of vagabonds gathered from the workshops and gutters of London—in this instance he is about to start down the Thames in a boat. It is comforting to reflect that there were surgeons and physicians on board.

> "Of every craft some there was
> Short or longe more or lesse
> All rehersed here before
> In Cock's bote eche man had an oar."

A pardoner has a list of the crew and Cock says, "What profit is to take thy pardon?" The pardoner replies,

> "Pope Nycoll graunteth you all in this texte
> The cough and the colyke the gout and the flyxe
> With the holsome totheache."

On board is Matthew, the toothdrawer of London, and it is tempting to connect him with Matthew Flint, who was appointed by Henry IV, who alludes to Matthew as our beloved subject "dilectus ligeus"—"to do all that pertains to his art to any of our poor subjects who shall at any future time require it without receiving anything from them on that account. We concede to the same Matthew six pence a day for the term of his life to be paid at our exchequer." Although this post may have been a sinecure, it shows that diseases of the teeth were prevalent, that there was, at this time, A.D. 1400, a separate calling of toothdrawing and a man sufficiently outstanding in that calling to be singled out for such a post.

Another toothdrawer mentioned by name was John Bryckett, who was made a member of the barber surgeons in 1551. He died soon after, for we learn that his widow, Mrs. Dawson, was forbidden to hang out her cloth with teeth on it "as she heretofore hath done." This proves that women practised toothdrawing as well as men, and there is a portrait of a contemporary of Mrs. Dawson in Paris, shown in "Æsculape," and Whitlock, the essayist, a century later in 1656, inveighs against women toothdrawers, calling them "quacking hermaphrodites, or the petticoat practitioner stript and whipp't."

"Nay if a beggar shall ask anything for the ache of his teeth he shall have it but nothing to set them agoing—the fame of curing them is greater than that of comforting them with food but that is the very principle of their charity of these liberal she-doctors—but oh! how it sounds to be called Mistress Doctor"!!

The celebrated Kindhart too, who may or may not have been Henry Chettle in Kindhart's Dreame, showers invectives upon quacks. I have always held that there were respectable toothdrawers who were like the surgeons, no better and no worse. The quack toothdrawer wandered through the country claiming to take out teeth "at a touch" at all the fairs and market places, singing his cry, "Touch and go, Touch and go, Ha'e ye any work for Kindhart the Toothdrawer, Touch and go."

Another toothdrawer, interesting from our point of view, was that one mentioned by Besant in his History of London, a certain Dr. Clark, who claimed to be toothdrawer to Charles II. He lived in Fountain Court, Strand, at the sign of "The Sun and Eye," and his motto was "Post nubila Phœbus."

A title much affected by toothdrawers was that of "Belphegor," which appears as a title to a waltz with the picture of a toothdrawer at work, showing how recently it was used. This title must have been handed down through the centuries and its original meaning entirely forgotten. Belphegor was the god of the Moabites and comes into the story of Baalam, Bel or Baal, the sun god, literally "he who possesses," and Peor or Phegor the mountain.

John George Keisler, Fellow of the Royal Society, travelling on the continent at the beginning of the eighteenth century, describes the busy market place at Turin, crowded with quacks of all descriptions, and he says, "The most modest of them all are the toothdrawers, for they claim to extract teeth safely and expeditiously with the help of St. Apollonia, and every time the Saint is mentioned, both the doctor himself and his audience take off their hats." He goes on to say that every part of the body has its saint. He overheard a peasant who was very confused between the saint and the part of the body saying, "Saint Throat help thou my blaise"!!

The Saint.

The saint, whom the Turin toothdrawers invoked, sprang into publicity at the end of the fourteenth century, when she became very popular, which would seem to

suggest that the diseases of the teeth were prevalent, a suggestion which finds support in the rise of the toothdrawer and the mention of toothache in all the popular literature throughout the civilized world.

Fox, the martyrologist, tells her story in the following words :—

"Mention is made of Apollonia, a virgin being something ancient whom they brought forth and dashing all her teeth out of her mouth made a great fire threatening to throw her into it if she would not blaspheme Christ, whereat she, making pause awhile leapt into the fire and was burned to death."

There is only one picture, so far as I am aware, which shows her as "a virgin something ancient," in which the artist, with a commendable economy, has shown her story in one picture. Her teeth are lying on the ground and she is shown in the background jumping into the fire to be burned to death. The most interesting part about this picture is the instrument lying on the ground. The sign of Apollonia is a pair of forceps, like the forceps in the temple of Apollo at Delphi. The only other representation of the Saint of which I am aware, where she is without forceps, is one on the rood screen at Somerleyton Church in Norfolk, where she has a hammer. The instrument in the above picture is a pelican which was introduced in the sixteenth century, when it superseded the forceps. The idea for this instrument was adapted from a tool used by coopers to remove staves from barrels, and I think that this artist wished to show how up to date he was by introducing this pelican, for this is a sixteenth century picture.

There is no mention of Apollonia before the end of the fourteenth century, when she was assigned a day in the Calendar, the ninth of February, just two days later than the birthday of Apollo, which was on the seventh of February, and whose festival at this time of year was called the Apollonia. It is worthy of note that the early church dignitaries were wise enough to transform into Christian festivals any day which had been celebrated as a public holiday from ancient times. About this time, the end of the fourteenth and beginning of the fifteenth centuries, religious enthusiasm and mysticism were at their height, and the church, deprived by such edicts as that of Tours and subsequent prohibitions, from the lucrative occupation of curing diseases by actual ministration, conceived the bright idea of reviving the mystery of the ancient gods, and attracted vast wealth by the erection of shrines to saints reputed to heal every disease under the sun. In ancient Egypt there were gods for every ailment and every member of the body. Pliny tells us that in Rome there were gods for all diseases ; and in medieval times the zodiac ruled every part of the body. Also, as Keisler says, "every part of the body had its saint."

The first to cast doubt upon these healers were the reformers, as we learn from the dialogues of Sir Thomas Moore who prepared his house at seven o'clock in the morning to receive the messenger from Luther, who came to argue all day long about pilgrimages and the worship of saints. The messenger says to Sir Thomas, "St. Appolyn we make a toothdrawer and speak to her of nothing but of sore teeth." There is a picture in the Wellcome Museum which is taken from a sixteenth century illuminated manuscript, showing Apollonia as a toothdrawer, and a beggar, who is receiving "something for the ache of his teeth."

Sir Thomas, who was a wise and witty man, says to the messenger, "I wene if your teeth akyd wel ye would think it a thyng worthy and not to simple to ask helpe of Saint Appolyn and of God to."

Then followed fierce denunciations, in which Apollonia is cited as the cause of much idolatry. Burnet, in his "History of the Reformation," says, "Anti-Christ draweth us away from thinking of the mercie of God and telleth us of other friends to whom we are beholding who have done so and so for us. It was Apollonia—it was Genovefa . . .," and Barnabe Googe, in his "Popish Kingdom," book III, "Helpers," says,

"To every saint they also doe his office here assine
And fourteen doe they count of whom thou mayst have ayde divine
Saint Appolin the rotten teeth doth helpe when sore they ake
Otilia from the bleared eyes the cause and griefe doth take."

Churches were dedicated to Apollonia, as for instance in Vienna, Ferdinard III of Austria raised a chapel in performance of a vow made when his son Leopold was cutting his teeth. It was not always wise to flout the saint as for instance, there was a bishop who destroyed her shrine but vowed to restore it. After his death all his teeth were found knocked out of his head. Her relics multiplied everywhere. In Cologne there appeared two mandibles. I have seen one of her skulls in a golden reliquary in the Museum in Lille in the north of France and there is another skull in another part of France and her teeth were as the stars in heaven for multitude. Keighley, in his History of England, speaking of the dissolution of the monasteries and the destruction of the relics of saints, says, "the teeth of Apollonia would have filled a tun." So extensive was her worship that Walther Bruch has been able to compile a whole book with representations of the saint taken from stone, brass, wood, stained-glass and canvas but there is no mention in his book of this country, where she had quite a respectable following. We went on a pilgrimage to discover her and found her in Norfolk and Suffolk, in Gloucester, Devon, Dorset, on the walls of Eton College Chapel and in St. Mary's Hall, Coventry. She is mostly on the rood screens, the exceptions being in Docking Church in Norfolk, where she is on the stone font, in Fairford Church, Gloucestershire, where she is in two of the stained-glass windows, the fresco on the wall of Eton College Chapel which is the work of William Baker, an English artist of the fifteenth century; and the tapestry in St. Mary's Hall in Coventry. She is very faded on the rood screens. The one at Barton Turf in Norfolk is too faded to be photographed. Prof. Tristram, the artist, has made a very beautiful drawing of this and G. W. Wynter has given a lyrical description of it, "on a green diapered ground with a rich nimbus with short rays indicative that she was made perfect in martyrdom, in a richly coloured mantle over an embroidered kirtle, her hair flowing, in her right hand a clasped book, in her left pinchers and a tooth. It is probable that this saint was chosen to appear on this rood screen with the heavenly hierarchy because she was the subject of angelic ministrations on several occasions. At her conversion, an angel directed her to St. Leonine to be baptised. On another occasion an angel appeared with a garment of dazzling white" (here we notice the introduction of the lion and the shining quality of the garment).

In Rome there are several churches with chapels dedicated to St. Apollonia, the most interesting of them, from our point of view is the Agostino church built in the fifteenth century on the site of the most ancient temple in Rome. The temple of Apollo built outside the Pomerium in the Campus Martius. It fell into decay and was restored after the battle of Actium by the Emperor Augustus who claimed to be the son of Apollo. Later on, he built a more magnificent temple on the Palatine and this old temple once more became a ruin, the Agostino church being built on its site. There on the ninth of February, Apollonia's day, young girls born on that day, when they came of marriageable age, used to repair to receive a dowry and a *necklace of pæony roots*. This we confirmed when we visited Rome in 1930, when the priest told us that the custom had fallen into abeyance because there was no more money.

And now we go to Guernsey, and to the Chapel of St. Paul, where the people go to pick the ivy leaves growing on the walls to chew for the relief of toothache. "Guernsey Folklore" by Sir E. MacCulloch, tells of the dedication and endowment of that Chapel "to Notre Dame de la Perelle appelaye St. Apolyn." It is easy to see how "Apollonia" has become converted into "Paul"; the ivy of Osiris and the pæony of Apollo are in these two instances both connected with Apollonia, and,

indeed, those red seeds of the pæony are called in different parts of Bavaria, Apollonia's grains.

And now we go to Spain. In the second part of "Don Quixote," the niece and the housekeeper has, by diligent nursing and diet, restored the knight to his right mind, when Samson Carrasco arrives and tells Don Quixote that his adventures have been published in a book. This excites him to such an extent that he determines to ride abroad once more. The housekeeper goes to Carrasco and implores him on her knees not to disturb her master. Samson treats her jestingly and tells her to go home and get something hot for his breakfast—"and on the way repeat Apollonia's prayer if you know it." The housekeeper says, "that would be some good if my master's malady lay in his teeth, but alas it lies in his skull." Samson says, "I am a bachelor of Salamanca and I know what I am talking about," that is, he knows that Apollo rules the whole head. I would like to emphasize these two phrases, "if you know it," and "I know what I am talking about," because in a contemporary publication, the first work on dentistry in the Spanish language published at Vallodolid in 1557, written by Francisco Martinez, there appears on the last page a representation of Apollonia and underneath, the following prayer:—

"Virgo martir egregia pronobis Apolonia. Funde preces ad dominŭ ne pro reatu criminŭ vexemur morbo dentiŭ,"

in which there is a significant omission which appears in all the prayers to Apollonia on the ninth of February in all the books of "Hours" which I have consulted. In the Sarum "Book of Hours" (1505) the prayer is the following:—

"Virgo xpi egregia p nobis apollonia kunde preces a dŭm p reatu criminŭ ne morbo vexemur dentiŭ *vel capitis torquentiŭ*," etc.

The line omitted from Martinez' work is that in italics.

In Spain, there is a toothache charm written on a piece of paper and hung round the neck, not only for the prevention but for the cure of toothache. It runs like this:—

"Apollonia stood at the gate of Heaven. The Virgin passed by. 'Say, Apollonia, what are you about, are you sleeping or watching?' 'My Lady, I neither sleep nor watch. I am dying of a pain in my teeth.' 'By the bright star Venus, *and the setting sun*, you shall never have toothache any more.'"

Could anything be more suggestive?—"the setting sun." Immediately, there comes into the mind a vision of the "Virgin something ancient" jumping into the fire to be burned to death, the myth of the setting sun. And the "bright star Venus" has an echo in Norfolk, where toothache is called the "love-pain."

In St. Mary's Hall, in Coventry, there is an ancient tapestry which was taken down for safety during the War and sent to South Kensington, where it was cleaned and photographed. In the top right-hand panel, Apollonia stands holding a pair of forceps. She is in attendance on the central figure, under whose feet is shown the crescent moon. This reminds us that Diana was the twin sister of Apollo.

In prehistoric times, men raised turf and stone altars in performance of their vows to their tutelary dieties; in later pagan times, they raised stone altars and more magnificent temples to their gods; in medieval times men raised shrines and chapels and churches to their saints. In modern times, people of wealth raise temples of healing, and the latest of these, is the Sunlight Clinic. At the actino-therapy department of the Royal Dental Hospital, patients go to receive body-baths and artificial sunlight to raise their resistance to dental and oral diseases.

"So sinks the day star in the ocean bed
And anon repairs his drooping head
And tricks his beams and with new-spangled ore
Flames in the forehead of the morning sky."

JOINT DISCUSSION No. 9.

Section of Neurology and Section of Physical Medicine

Chairman—J. S. RISIEN RUSSELL, M.D. (President of the Section of Neurology).

[*March* 16, 1933.]

DISCUSSION ON THE CAUSATION AND TREATMENT OF INTERSTITIAL NEURITIS.

Dr. Wilfred Harris: By the term "interstitial neuritis" we understand an acute or chronic inflammation of the supporting connective tissue binding together the separate nerve-fibres into the bundles we call nerves. As a result of such an inflammation the actual nerve-fibres themselves are liable to be compressed and damaged, thus setting up a degeneration of the nerve-fibres, with consequent motor and sensory loss in the territory they serve. The irritant effect of this interstitial inflammation upon the nerve-fibres will be to cause pain and cutaneous hyperæsthesia in the sensory areas served by the nerve involved, and also deep muscular tenderness, bone-ache and joint-pains in the same area, while tenderness over the site of the inflamed nerve will be produced by the involvement of the nervi nervorum supplying the nerve sheaths.

In this paper I do not propose to refer to rare forms of neuritis, such as chronic hypertrophic neuritis, but more particularly to such forms as result from the commoner acute and chronic infections. Such neuritis may result from the chronic toxæmia of alcoholism or diabetes, in which both interstitial and parenchymatous nerve degeneration may occur together, or following certain fevers, as paratyphoid, or the more chronic infection from dental sepsis, or distant suppuration.

Another class of cases is due to the local spread of neighbouring inflammation, as in tuberculous caries, or the more chronic process of fibrositis of the shoulder- and back-muscles, involving the finer nerves, and causing the well-known pains of so-called muscular rheumatism and lumbago. In the latter case, when the inflammatory process spreads over the ilium to the sciatic notch, the sheath of the sciatic nerve will become involved, and sciatica results. In a similar way fibrositis of the neck muscles may give rise to brachial neuritis, through involvement of the main trunks of the brachial plexus. More troublesome are those cases in which a rheumatic or osteo-arthritic process involves the spinal nerves at the intervertebral foramina. In the lumbar region we then see that obstinate form of sciatica with contralateral scoliosis, in which the trunk is flexed laterally away from the painful side.

Osteo-arthritis of the hip-joint may also give rise to very troublesome sciatica by direct spread of a chronic inflammation to the sheath of the sciatic nerve which passes close behind the joint.

Actual chill to the surface may set up an interstitial neuritis, such as sciatica, or facial palsy, and direct injury through contusion is a not uncommon cause of sciatica, through a heavy fall on the buttock, as in the hunting field. Heavy muscular overstrain similarly may give rise to a brachial neuritis or to sciatica, and it is important to bear in mind in the after treatment of sciatica that patients should be warned against heavy efforts, such as moving heavy furniture, or carrying a heavy suitcase, for at least a month after the disappearance of the pain.

Treatment.—The treatment of interstitial neuritis may be divided into that of the acute and that of the chronic stages, and the methods of treatment into physical and medicinal. Of the latter, rest is important in the acute stage, and sedatives and opiates often play a necessary part in allaying pain and promoting sleep. Iodine is also of value in the chronic infections, and strychnine and other tonics—as oil and radiomalt—in the later convalescent stage after an acute neuritis, when the pain and tenderness have disappeared. Arsenic, like alcohol, should be avoided during the treatment of neuritis, as both drugs are capable of producing neuritis, if given in excess. Massage is usually borne earlier than either strychnine or electricity.

Acute brachial neuritis or acute sciatica must be treated by complete rest in bed, though in my experience attempts at complete immobilization of the limb by splinting or plaster are not well tolerated, as patients feel that change of position is essential, even if movements are somewhat painful. The upper extremity is best rested on large soft pillows and wrapped in thick wool or Gamgee tissue up to the neck. Diathermy I have not found of much service, but radiant heat applications often give some relief. I have not found ionization successful in acute brachial neuritis—usually it has accentuated the pain—but liniments such as A.B.C. liniment and methyl salicylate, menthol, and camphor, applied gently twice daily, have been useful. When moist heat is comforting, then large linseed or antiphlogistine poultices or plasters to the upper extremity, day and night, with the two liniments mentioned used alternately between the poulticings, are, I think, the most useful treatment, while the severity of the pain must also be mitigated by analgesic drugs, such as combinations of phenacetin or pyramidon with aspirin, and in the worst cases the addition of omnopon, morphia or heroin, with a little medinal. Five grains of Dover's powder, with five each of pyramidon and aspirin, is a useful remedy which may be repeated every six hours. Even injections of morphia may be necessary. I have little or no faith in treatment by coloured light, blue or red, or by high frequency currents, or by X-rays, except as instruments of suggestion.

Acute brachial neuritis only rarely leads to a condition of chronic neuritis of the arm, cure usually being complete in from four to eight or ten weeks. Very different is the course of events in a large proportion of cases of sciatica. Sometimes an acute stage subsides into a chronic stage, which may last for months or even years, in which the patient has constant pain on movement, especially on stooping to his feet, and on coughing or any straining. The gait is limping, with the knee kept slightly flexed, and the body leaning to the affected side. The Achilles jerk will probably be absent, and the foot may be cold and slightly blue, and even partially anæsthetic. In extreme cases which have continued for several years the muscles of the leg will also be wasted.

The sciatic nerve in such cases will be found, if cut down upon, to be somewhat shrunken and tough and cord-like for the three or four inches below the notch, and the best treatment is to scarify the nerve longitudinally, carefully separating the nerve bundles from the scar tissue.

The old surgical procedure of stretching the nerve by pulling on it is quite useless in such cases, though occasionally in partially recovered cases, not very severe, when spontaneous pain is gone, and pain is elicited only on stooping to the feet, then forcible flexion of the hip with the knee straight, under an anæsthetic, may break down adhesions between the sheath and the surrounding tissues, and cause great

relief. Another method of stretching the nerve bundles laterally instead of longitudinally, and thus separating the adhesions and intraneural scar tissue produced by an interstitial neuritis, is by injecting the sciatic nerve below the notch with from 80 c.c. to 100 c.c. of warm normal saline. This method of Lange's I use frequently, two injections at an interval of four or five days being sometimes necessary. It must of course be done under local anæsthesia only, as one depends entirely on the patient's signal of pain in the ankle or foot when the needle reaches the nerve. This is then injected with 2 c.c. of 2% novocain, when the subsequent injection of the saline is quite painless. This treatment is indicated especially in chronic sciatica, with pain on straining and stretching, with loss of Achilles jerk, and with a tendency to contracture towards the affected side.

I have seen quite dramatic cures within a week, of patients who had been limping in pain for as long as two and three years. For the high type of sciatica, in which the Achilles jerk is unaffected, and there is contralateral scoliosis, saline injection at the notch is useless. In these cases paravertebral injections of novocain and saline are indicated.

Rest in bed is essential for these cases, sometimes for as long as three months.

Before any case of sciatica is dealt with by injection methods, the teeth and tonsils should be carefully examined for chronic sepsis. I have seen an apical abscess of only one tooth responsible for an obstinate sciatica, which had defied all treatments by rest, electricity, and saline injections; the pain disappeared within a week of the extraction of the tooth.

Ionization is sometimes of great value in the less acute stages of sciatica, and if carefully given, currents of 40-50 milliamperes, or even more, may be employed. Thick felt or Gamgee pads must be used, and kept well wetted. I usually order the negative electrode on the buttock, and a large positive plate under the thigh just above the knee, with weak salicylate solution on the negative, and lithium carbonate on the positive, but I think we deceive ourselves if we think that it makes much difference whether the general run of the current is upwards or downwards, or whether this or that drug is used for ionization. The amount of the latter that is absorbed into the tissues is microscopical, and is probably carried away by the blood-stream before it could reach the nerve trunk.

Acupuncture, a treatment originally recommended by Sydney Ringer, has been used in the treatment of chronic lumbar fibrositis and sciatica, the idea being to thrust half a dozen stout needles into the nerve along its course below the notch. Probably only those who have practised saline injections of the nerve can estimate the proportion of times in which the nerve is hit by one of the needles in acupuncture, probably not one in ten. Acupuncture is more likely to be of service in acute lumbago than in sciatica, and the intensity of the pain and discomfort of a lumbago which may seize a patient quite suddenly requires urgent relief. This may sometimes be brought about by smart faradization of the muscles in the painful area, or by a deep injection of novocain solution, or impletol.

A newer remedy, "gorun," may also be used for intramuscular injection, but it is somewhat painful. Cachets of this drug may be given orally. Vibratory massage, radiant heat and diathermy, mustard poultices and radio-active mud baths may all, in different cases, succeed. For this type of case and for some chronic sciaticas the deep saline baths of Droitwich are especially useful. These may be combined with the Vichy douche and massage.

In some cases of chronic fibrositis of the back- and shoulder-muscles there will be found constant tender points, on which the pressure of the finger causes sharp pain like a needle-point. Alcohol piqûre of these tender points, using a hypodermic needle vertically down to the rib level, is an excellent treatment, and if the alcohol is correctly placed, it destroys the nerve-ending caught in the scar of a patch of neurofibrositis, so that muscular movement at once becomes painless.

Dr. M. B. Ray: The sheaths of the nerve trunks, the delicate areolar tissue that binds the nerve-fibres together, the coverings of the muscles, their tendinous attachments, the fascial planes and the capsules of the joints are all derived from prolongations of the connective and white fibrous tissues found in every part of the body.

To this unified connective tissue, Achard gives the name "lacunar system." A study of its embryology and morphology shows it to consist of actual and potential spaces within mesoblastic elements. As Hare points out, these connective tissue spaces of microscopic dimensions are enlarged not into only nerve sheaths and coverings for muscles, but into articular cavities, bursæ, etc. All are therefore formed from the same elements and all contain transudates from the blood-plasma, the percentage composition of which varies slightly according to variations in the functions of the different spaces.

These supporting tissues, in which inflammatory reactions take place, are among the lowest in the cellular hierarchy. The reactions are relatively simple and constitute the response of such a tissue to irritation of any kind, be it traumatic, bacterial or metabolic.

The recognition of such a lacunar system has an important bearing on causation. Just as some people are born with a circulatory, a respiratory, or an alimentary organ inferiority, a similar inferiority may be inferred with regard to this lacunar system, which would prove a handicap to the individual in his struggle against such adverse influences as chills, climatic vagaries, external or occupational conditions, bacterial invasions, unsuitable food and so on. In other words, the power of adaptation in such individuals is deficient.

In speaking of environmental conditions, it must be remembered that they are not limited to so-called external conditions, but embrace everything that interacts with the individual, be it a group of his cells or the whole organism. For example, unsuitable food lying in the digestive tract is an "environmental condition." The toxic state that ensues is due to the inadequacy of the adaptative functions of the body. The toxin, whatever its nature may be—metabolic or infective—can only gain access to the tissue cells by the fluids which permeate them. In this sense, the circulating fluids—blood, plasma and lymph—are to be regarded as an internal environment and therefore intimately concerned with faulty processes that the body is unable to rectify.

Into the relationship between faulty metabolic processes and an imbalance of the sympathetic and parasympathetic systems, it is hardly necessary to enter. It is, however, necessary to stress the important rôle played by the skin in the interaction between the body and its external environment. Acting as a buffer, it determines the reactions to heat, light, cold, etc., by means of its vast area of sensory nerves. This is brought about by the close relation between the skin and the thyroid-adrenal-sympathetic system. Cramer has shown that the regulation of bodily heat is a function of the latter system. In order to withstand the ill-effects of long-continued cold, this system must work at its maximum efficiency. Individuals whose endocrine-sympathetic systems are inadequate present well-recognized types. Such people are only happy in warm climates. In cold damp weather they are always more or less ailing. They suffer from asthma, constant succession of colds, lumbago, sciatica and so on. To put it shortly, they are the kind of individuals who are most prone to suffer not only from interstitial neuritis, but also from inflammatory states of the supporting structures of the muscles, the fascial planes and the peri-articular tissues.

This faulty adaptation not only affects the so-called physical surroundings; a careful inquiry into many cases will reveal a mal-adjustment with regard to the affairs of everyday life. Business worries seem to have a direct relationship to attacks of brachial neuritis. Many cases of sciatica clear up directly some pressing anxiety is removed.

Treatment is both general and local, and varies according to the stage of the disease.

(1) General treatment will deal with any underlying constitutional state. In gouty cases, colchicum is obviously indicated. Gowers recommended a grain of blue pill once or twice a day. For the relief of pain, aspirin is probably the safest drug but it may be necessary to reinforce its action by codein or hypodermic injections of morphia.

The teeth, tonsils, nasal sinuses, and any other situation in which a septic focus may lurk should be carefully investigated because it is futile to attempt any treatment as long as a causal focus of infection remains active. Until any discoverable focus is removed or dealt with it is impossible to say whether it is causal or not. Very often it will be found not to be; but there are numerous instances in which the removal of a focus has been followed by brilliant results.

In the early stages rest is of supreme importance. When the lower limb is affected as in sciatica, the patient must be kept in bed on a hard mattress. All local treatment must be so devised that it can be applied in bed. A long sand-bag may be laid alongside the affected limb and fixed to it by knotted handkerchiefs. A Liston's splint has the advantage that the patient may be turned over without entailing any movement of the thigh.

When the upper limb is affected it must be supported in a sling or a suitable splint in order to take the weight from the shoulder. The drag of the limb very much increases the pain in these cases.

(2) Local treatment: Heat is a sovereign remedy in the relief of pain. To be effective it should be intense or as hot as can be borne. It will be remembered that the sensory conduction of a heat stimulus to the cortex is practically identical with the path taken by sensations of pain. For this reason an intensive heat stimulus will sometimes "crowd out" painful impulses.

For some reason, moist heat appears to be more effective than dry heat, at any rate at the earliest stages. Hot mud packs are very soothing and are easy of application. Fuller's earth will do quite as well as mud; and the pack is prepared in exactly the same manner as a linseed poultice (a time-honoured remedy of proved efficiency). The pack probably acts by decongesting the deeper organs due to dilatation of the superficial vessels. Melted paraffin wax applied by means of a brush or dipper is also very soothing. After about five or six coats have been laid on, the part is covered with waxed paper and allowed to remain in position for half an hour. On the removal of the wax, a copious perspiration will be found to have been induced, and the pain to be considerably mitigated. In many cases of either brachial or sciatic neuritis, cloths soaked in a hot solution of mustard and laid along the arm or the back of the thigh to act as a counter-irritant are often very effective. Many patients find that a radiant heat apparatus which can be placed over the bed, gives a measure of relief; it is more effective if it induces sweating. In more obstinate cases blistering is of undoubted value. A series of small ones applied along the limb gives the best results.

Massage during the acute stage is contra-indicated so far as the actual affected part is concerned. It may however be given to the unaffected limbs and will prove helpful in promoting tissue metabolism and aiding in the removal of waste products which are apt to accumulate owing to the enforced rest.

Mild galvanic currents with the positive electrode over the calf or forearm have an analgesic effect.

Diathermy should not be employed during the acute stage because it has been found to increase the pain. By raising the temperature of the deep-seated parts, it stimulates a flow of blood to where it is least wanted. Packs and hot surface applications have quite a different action in that they bring the blood to the skin and thus decongest deeper parts. The object of diathermy is to stimulate the removal

of exudations and the products of tissue inflammation by increasing the flow of blood to the affected parts.

With regard to treatment in the later stages: Many kinds of interstitial neuritis are very tedious and slow in their progress toward recovery. This is especially the case with regard to sciatica. In uncomplicated cases, however, a definite amelioration of the symptoms should be looked for after the lapse of a month or six weeks. Diathermy may be freely employed. In the case of an extension of a fibrositic process from the lumbar region to the sheath of the sciatic nerve, it should be given over the sacral and lumbar regions. As a result of the inflammatory processes in the nerve sheath and the surrounding parts, a considerable amount of infiltration is bound to take place.

The muscles, from lack of use, lose tone and show signs of wasting. They are often tender and stiff. In the upper limb there is always the risk of a stiff shoulder. Passive movement should be carried out every day to obviate this. In the very early acute stage this should be begun within a few days because it is surprising how quickly a shoulder-joint will lose its full range of movement.

Massage can be carried out daily—gentle effleurage at first to remove congestion and serous effusion. Vigorous kneading along the course of the nerve will do far more harm than good. If it is done with the idea of breaking down adhesions, all that happens is the substitution of new ones for old. Later, when the case appears to be entering on a chronic stage, more vigorous methods may be employed with advantage. If available, massage under a stream, or streams, of hot water is very effective, as also is the Scotch or alternating hot and cold douche.

Injections of oxygen often give instant relief. No attempt should be made to penetrate the nerve sheath. The oxygen infiltrates the subcutaneous tissue and by its mechanical presence provides a cushion and a protection against jars to a painful limb. This of course applies more especially to cases of sciatica. An ordinary oxygen cylinder is used. A hypodermic needle at the end of a piece of tubing leading from the cylinder is inserted over a painful area and kept there as long as infiltration with the gas continues. A second injection is then made elsewhere and the whole process repeated a few days later if necessary.

In cases that are becoming intractable, the injection of a normal saline solution may be tried. It is usually made at the level of the ischial tuberosity or in the middle of the buttock. A preliminary injection of novocain should be given into the nerve sheath. There is often a good deal of pain and discomfort following these injections and sedatives may be needed.

Acupuncture, or "needling" the nerve, is sometimes performed with considerable success. It should only be done in very chronic cases. The nerve is pierced in several places with stout, sharp-pointed needles. Sterilized hat-pins will do quite well. They are left in situ for from a quarter of an hour to twenty minutes.

Where there is reason to believe that the sheath of the sciatic nerve is adherent to the surrounding tissues, forcible flexion of the thigh upon the abdomen with the knee-joint extended will often break down any adhesions that may have formed. A general anæsthetic is usually required during this procedure.

The open operation for stretching the nerve—very much the vogue at one time—is rarely carried out in these days.

Dr. J. P. Martin: I propose to refer briefly to the pathology of interstitial neuritis and to consider how far it offers an explanation of the symptoms of the condition or gives indications for treatment.

Interstitial neuritis, according to its definition, is a condition in which there is inflammation in the fibrous and other tissues of the nerve trunks, but how many of us know what form this inflammation actually takes and what abnormal appearances are present in sections of the affected nerves? I confess that until a

few weeks ago I had never studied the pathology of interstitial neuritis, but I have recently had an opportunity of examining some sections belonging to Dr. Denny Brown, and a very good description is given in the article by Gibson and Fleming in the "System of Medicine" edited by Allbutt and Rolleston.

The affected nerves become red and swollen, and in microscopic sections effusion is seen into the various interstitial structures of the nerve trunk. You will remember that each bundle of nerve-fibres is surrounded by a fibrous membrane which is called the perineurium; this is a lamellar, fibrous structure. Enveloping the various bundles and uniting them into one trunk there is a larger fibrous mass, the epineurium. The exudate which occurs is apparently of a sero-fibrous nature. It is seen in the epineurium in spaces laying parallel to the nerve bundles. Exudation is seen also between the layers of the perineurium, but what is most striking is that it is found under the perineurium, that is to say, actually in contact with bundles of nerve-fibres. In addition to the exudate there are small collections of leucocytes which are found in association with the exudation itself and also lying along the small veins.

This pathological picture does not afford any complete explanation of the symptoms. The dominant symptom in almost all cases of interstitial neuritis is pain, and it is not easy to see from the pathology how this pain is produced. One might think that the pressure of the exudate on the nerve-fibres would suffice to cause pain, but pressure of itself, as we know from other conditions, does not give rise to pain. We must suppose that in addition there is an inflammatory state which excites the endings of the nervi nervorum. The occurrence of paralysis is easier to understand from a study of the sections. On the whole, paralysis is uncommon in interstitial neuritis, but that applies chiefly to the large nerve trunks. When smaller nerves are affected, paralysis is relatively common. It occurs in the facial nerve and in the long thoracic nerves and it may be the only symptom by which we recognize the neuritis in such nerves. We see paralysis similarly in the anterior crural nerve which is also a relatively small trunk. And even in sciatica, when the neuritis has existed for any considerable time it is common to find some wasting of the calf, or fibrillation in the calf muscles, and, of course, absence of the ankle-jerk—all indications that a number of the nerve-fibres have been paralysed.

There is one form I wish to refer to because it has been brought to my notice again recently, and that is the form that has been called "radiculitis"—an interstitial neuritis affecting one spinal root or one root of the brachial plexus. It is mentioned by Gowers, and was described later by Buzzard.

I have in hospital at present a young man who has paralysis of the muscles innervated from the fifth and sixth cervical roots on the right side. This paralysis came on in association with what was apparently fibrositis of the right shoulder and right side of the neck. There was intense pain and tenderness over the area of the neck muscles for two or three days, and then weakness round the shoulder and paralysis of the shoulder-girdle and upper arm. All the affected muscles are supplied by the fifth and sixth cervical segments. All the cases I have seen of this condition have involved the fifth cervical root. Why that root is more liable than others is not quite clear, but it runs a longer course among the neck muscles and areolar tissues than the other roots of the brachial plexus, and that may be the reason. Cases of radiculitis make a good recovery and they recover quickly, or at any rate, much more quickly than parenchymatous neuritis. They always have pain, and probably the neuritis arises in association with fibrositis close to the vertebræ.

The main indications for allaying inflammation of any structure are rest and warmth. In the treatment of interstitial neuritis generally, I think rest is the most important element—but it must be absolute rest. In brachial neuritis it is not sufficient to tell the patient he must not use his arm. The arm must be in a sling,

and possibly even in a splint. Then it is surprising how quickly the pain is allayed.

The other great stand-by is heat in some form, and I agree with Dr. Harris that among the special forms radiant heat is more satisfactory than diathermy. Another indication for treatment is counter-irritation; all the liniments are included in that group, and perhaps acupuncture should be placed in it too. After studying the sections to which I have referred, I am inclined to try acupuncture, which, in the presence of so much exudate, seems a rational procedure. With regard to injection methods: The injection of saline into the nerve is very successful, though I do not quite see the rationale of it. I have performed injection into the epidural space, with the idea of distending the sheaths of the nerve roots. I began by using a strong solution of antipyrine, but I gave that up because in one instance the injection was followed by hæmaturia. I now use saline, with a very little novocain, distending the space with 100 c.c. or more of the saline. This is moderately successful for high sciatica. One cannot make promises about the results of any treatment in sciatica, and all that can be said about epidural injection is that in the difficult group of root sciaticas it is the most successful treatment.

Injection of oxygen I have used a good deal, and on the whole it has given very good results. It possibly acts as a counter-irritant and may increase the circulation to the part. The cushion effect is also, I think, part of the reason for its success; and where there is fibrositis the oxygen may permeate the inflamed fibrous tissue, separate inflamed surfaces, and so relieve pain.

Mild stretching I frequently use where the cases are slow in clearing up, but I only use it as practised in the massage department, where the leg is extended daily as far as can be tolerated.

I only use these various methods of treatment in cases in which I am satisfied that the sciatica is primary, because when there is associated arthritis of the hip, I do not think it is worth while treating the nerve.

In association with the "local" methods, some general treatment should be used. Recently, in view of the work which has shown how vitamin A helps the body to resist and overcome infection, I have used radiostoleum and similar preparations; general tonics too have their place.

Dr. Barnes Burt: *The so-called "rheumatic neuritis" group.*—Both Gowers and Osler consider that this condition is due to an interstitial neuritis. Gowers emphasizes this very strongly. Llewellyn considers that in the commoner forms of sciatica and brachial neuritis the nerve shows no sign of inflammation; my own views agree with the latter authority. The average case generally consults the physician before obvious inflammatory changes occur in the nerve, but in severe and neglected conditions there is a perineuritis, followed by interstitial neuritis. The cases are really pre-interstitial. The condition is nearly always secondary to bursitis, arthritis or fibrositis of neighbouring structures. Primary inflammation may occur as the result of chills and exposure. This is seen in facial palsy, but elsewhere it is very rare. Even in trunk sciatica the neuritis is generally due to the spread of inflammation from the gluteus maximus. The older authors laid a great deal of emphasis on gout as a cause. This is an ætiological factor in fibrositis, etc., and is thus an indirect cause, and in the same way focal sepsis may be an indirect cause.

In its simplest form rheumatic neuritis is seen in the great occipital nerve. The nerve pierces the tendon of the trapezius muscle about an inch below its insertion into the skull. Swelling of the muscle-fibres presses on the nerve and sets up pain in the skin area behind the ears giving rise to the so-called rheumatic

headache. The inflammation may spread into the nerve tissues of the great occipital nerve, producing hyperæsthesia and tender areas at the back of the head.

Brachial neuritis.—The causes of this condition are much more complicated. The majority of the really severe cases, with trophic changes, wasting of muscle and severe hyperæsthesia (cervical rib excluded) are due to arthritis of the cervical intervertebral joint, or at least inflammation in the fibrous tissue around the nerve roots. It is interesting to note that spondylitis ankylosa practically never sets up neuritis, although it is a very severe form of arthritis, the explanation being that it is a dry sclerosing form of arthritis which rapidly immobilizes the joints. There is no fluid formation, hence no pressure on the nerve roots in the intervertebral foramina. But osteo-arthritis and traumatic arthritis do set up neuritis. Some of those conditions which come on after a faulty golf stroke in a bunker are I believe due to some sprain or overriding of the cervical joints.

A type of neuritis commonly met with in spa practice, particularly in the Devonshire Hospital, is that due to subacromial bursitis. Inflammation of this bursa may spread to the circumflex nerve as it curls round the surgical neck of the humerus, and thus set up pain down the back of the arm as far as the wrist. This is the only form of brachial neuritis in which pain is confined to the back of the arm. This distribution along the cutaneous branches of the musculo-spiral nerve is due to the fact that both nerves come from the posterior division of the brachial plexus and are derived from the fifth and sixth cervical roots. In many of the cases there is merely a dull ache but I have seen a few cases in which the pain was agonizing, sleep almost impossible and the inflammation had spread into the tissues of the circumflex nerve.

Fibrositis of the supra- and infra-spinatus muscles is a common cause of pain in the arm and hand, and of pins and needles and tingling in the finger tips. This group is particularly interesting, because in spa practice it is the most frequent single cause. The treatment is on clear-cut lines, and there are practically no references to it in medical literature. Gowers states that brachial neuritis frequently begins with pain over the scapular region, but beyond that I have come across no other references.

The spinati muscles are somewhat exceptional in that they work in a tightly confined space. A cross-section is triangular. On two sides are bony walls and on the third a strong aponeurosis. The supra-scapular nerve, passing through the supra-scapular notch, sends the branch along the surface of the bone to supply the supra-spinatus, and then winds round the spine of the scapula to supply the infra-spinatus muscle. Thus, any inflammatory swelling in the muscle, not necessarily near the nerve, exerts a definite pressure on the nerve, squeezing it against the bone, and it is possible that the venous circulation is also interfered with in some cases.

The supra-scapular nerve derives its fibres from the fifth and sixth cervical roots, and irritation of the nerve gives rise to pain in the skin supplied by the musculo-cutaneous and median nerves; namely, front and outer side of arm, the hand and all the fingers except the little finger. In severe cases the inflammation spreads into the nerve, and wasting of the muscles occurs.

With the possible exception of the trapezius and glutei, these muscles are the most common site of fibrositis, for the following reasons: (1) The wearing of heavy coats hanging direct from the shoulders. (2) The wearing of low evening dresses and exposure to draught. (3) The craze for knitting—since it is these muscles which abduct the arm.

Dr. Williamson, of Manchester, suggested that the wearing of tight braces, or the carrying of a heavy weight on the shoulder, set up neuritis, as a result of direct pressure on the brachial plexus. I think that pressure on the supra-spinatus muscle is a simpler explanation.

On the whole, sciatica is not such a complicated problem as brachial neuritis,

and in comparing the two conditions it is convenient to take the main clinical groups separately.

Root sciatica.—This is most commonly due to arthritis of the intervertebral joints, and far commoner than root brachialgia. Following on the work of Putti, it has been found that this is the commonest cause of sciatica. This type seldom if ever sets up the extremely severe neuritis with trophic changes, shiny skin and contractures seen in brachial neuritis. Putti's suggestion that the relative size of the invertebral foramina and nerve root is one explanation of this. The cervical roots fill far more of the foramen than the lumbar roots.

Trunk sciatica.—The sciatic nerve is such a large structure that one would have expected a primary neuritis to be frequent. However, neuritis is more often due to a spread of inflammation from the gluteus maximus or its sheath, or from fibrositis of the pyriformis muscle. Here we see the main difference between brachial neuritis and sciatica, for the well-marked sheath may develop adhesions to the nerve trunk or to the gluteal fascia, and thus be a cause of pain for years.

Referred sciatica.—The sciatic nerve sends a small branch to the hip and sacro-iliac joints, and the inflammation in these joints may set up pain down the legs, although there is no actual inflammation in the sciatic nerve, only in the small branch.

Again, just as brachialgia may be due to inflammation of the spinati muscles, so sciatica may be due to fibrositis of the gluteus medius, although that muscle is not supplied from the sciatic plexus.

In the gluteus medius we have a condition analogous to that in the spinati; it lies on bone and is covered by a dense aponeurosis. The branches of the superior gluteal nerve travel along the surface of the ilium to supply the muscle. Swelling of the fibres in this confined space presses on the nerve and pain is referred to areas supplied by the fourth and fifth lumbar roots.

Treatment.—For hundreds of years physical treatment has proved to be of the greatest value in dealing with this troublesome condition and Spa treatment offers the safest and easiest method of providing this.

In the first place movements of limbs which are almost impossible to carry out at home can be performed in deep-water baths, particularly when peat-packs and hot mud are applied to the area of primary trouble before the patient gets into the bath.

Secondly, the undercurrent douche is a safe and painless form of massage. It encourages the lymphatic and venous circulation at a time when massage is too painful, and in the massage douche baths, massage under water is generally not nearly so painful as dry massage.

Again, there is the specific action of radio-active waters on gout, and a general eliminating effect of drinking natural waters, together with the promotion of skin activity by the action of baths.

Massage, for the treatment of neuritis, has a bad reputation among both doctors and patients, although judiciously applied it is the most valuable treatment for a number of cases. The bad reputation is to some extent the fault of doctors, who in the past have casually ordered massage without stating the area to be treated. If this question is left to the patient or masseuse it is quite easy to understand that the site of greatest pain is generally chosen for the operation. Massage is indicated in practically all cases in which fibrositis of the muscle is the cause. It is contra-indicated where arthritis or bursitis is the cause, except very late in the disease when most of the pain has disappeared and the muscles are wasted. The physician must be most careful to indicate the area to be treated and must choose the right time. If, as the result of tests carried out by himself, he considers the muscle too tender, three or four applications of constant current and radiant heat should be

tried and the muscle tested again by the physician. It is wise to warn the patient that the first three applications of massage may be painful, but as long as the pain is not increased four hours after the massage it is safe to continue the treatment.

Dr. D. Denny-Brown: The pathology of localized neuritis is of necessity seldom verified. At a time when it was not uncommon for patients suffering from chronic sciatica to have the nerve exposed at operation for stretching, it was observed that the nerve was often definitely swollen, œdematous, and injected. In more chronic cases it was reported occasionally as shrunken. It was apparently not infrequent for no change to be demonstrable. A few cases reported in the literature—by Hunt,[1] Thomas[2] and others—in which patients suffering from an acute sciatica had come to autopsy, showed very slight evidence of change in the affected nerve. Small areas of infiltration, œdema and thickening of the perineurium, and abnormal collections of fat were described, but have been discredited by many authors on account of the slight degree of change and the inconstancy of the picture. Gowers[3] stated that exudate in the perineurium though slight, was constant and was convinced that true sciatica was a neuritis rather than a neuralgia. Cotugno[4] is reported to have drained half an ounce of fluid from the inflamed nerve by puncture.

The following case—on account of the opportunity afforded for pathological investigation—seems worth consideration here.

E. R., female, aged 30, was suffering from disseminated sclerosis, which, however, seemed both clinically and pathologically to have nothing to do with the condition under consideration, though possibly contributing to her demise. In October, 1929, she began to suffer from pain in the right leg, which was in the nature of a continuous ache down the back of the leg, from the buttock to the calf. It was painful to extend the leg and walking was made difficult. The pain varied in degree, but in December it became very much worse and the patient was admitted to hospital. She had signs of a severe right-sided low sciatica (the "trunk" sciatica mentioned by Dr. Barnes Burt), with maximum tenderness of the nerve at the region of the sciatic notch and extreme pain if the knee were extended and the hip flexed. She was treated with massage and radiant heat without relief, and in January, 1930, she had a subcutaneous injection of oxygen at several points in the right thigh, with immediate, but not complete, relief which lasted about four weeks. There was still some slight tenderness of the nerve, and as there had been no abnormal physical signs other than tenderness on stretching the nerve the improvement objectively was only in her ability to walk without pain.

In February, 1930, the pain became worse again, and after some four more weeks she was again admitted to hospital, then having pain from behind the trochanter to the right heel. There was no pain elsewhere. There was no wasting, or loss of ankle-jerk, or loss of sensation, but the sciatic nerve was now very tender from the popliteal space up to the sciatic notch, where the tenderness was greatest. There was no evidence of involvement of the sacro-iliac joint, of the antero-crural nerve or any other structure than the sciatic nerve. Stretching the sciatic nerve caused a shooting pain down to the heel; it was painful to put the right foot on the ground. The patient was treated by gelsemium and phenazone by mouth, by radiant heat to the right lumbar region and posterior aspect of the right thigh for twenty minutes three times a week, some applications being followed by a gentle deep massage after each application, by diathermy through the lumbar region by flow-line applicator for from ten to twenty minutes three times a week (under 1 amp.), and complete rest in bed. These treatments were continued for twelve days, at first with some slight relief except from the diathermy, which, she stated, caused an exacerbation of the pain. After ten days the pain became more severe and the patient begged to have an oxygen injection such as she had had before. This was given, but on this occasion the injection was given in the deep tissue-spaces around the

[1] Hunt, "American Medicine," 1905, ix, 620.
[2] Thomas, *Rev. Neurol.*, 1905, p. 139.
[3] Gowers, "Diseases of the Nervous System," vol. I, 1888.
[4] Cotugno, "A Treatise on Sciatica," 1775 (quoted by Hunt (1)).

sciatic nerve, and though it proceeded satisfactorily up to a point, the patient suddenly collapsed and died with signs of cardiac arrest. At autopsy it was found that some oxygen had passed retroperitoneally through an abnormally large and patent sciatic notch, although this did not seem sufficient in amount or to have extended sufficiently far to have caused cardiac embarrassment.

Extensive disseminated sclerosis was found, and this had presumably played some part in the causation of the collapse, but it did not involve the sacro-lumbar cord. There was no evidence of oxygen embolism.

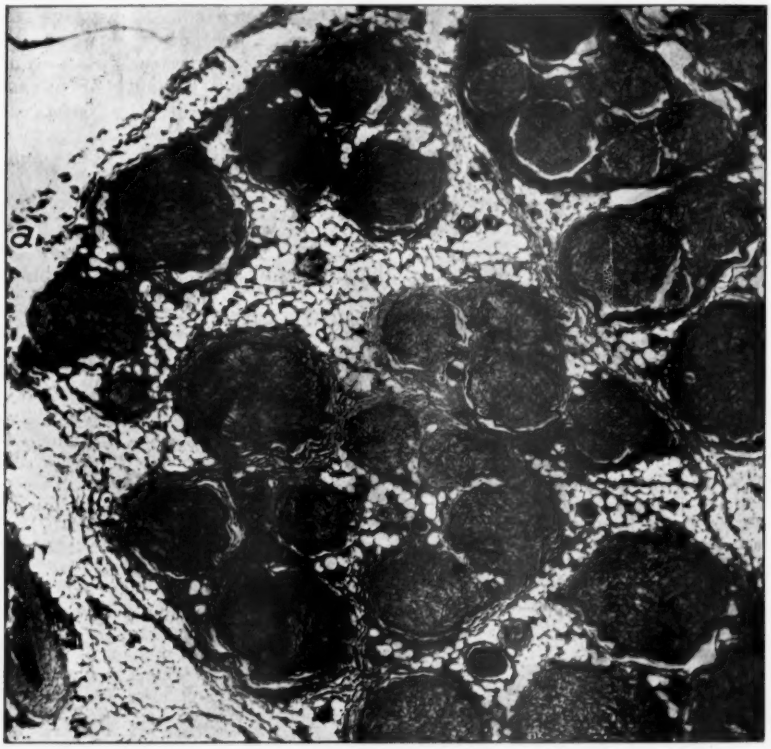


FIG. 1.—Low-power view of transverse section of the sciatic nerve referred to in the text. Iron hæmatoxylin and Van Gieson. Many of the spaces around the nerve bundles are shrinkage artefact, but in two bundles opposite the letter "*a*" some clot is seen within the perineural space. The amount of endoneurium, perineurium and epineurium is within normal limits. Figs. 2, 3, 4, and 5 are photomicrographs of longitudinal sections of the same nerve.

The sciatic nerve on the right side was swollen over the whole of its course from the sciatic notch to the popliteal region and the blood-vessels were noticeably engorged. There was no sign of "adhesions" or other fibrous tissue change. The nerve was unfortunately not removed complete for investigation and the histology described below is from a piece of the nerve kindly allowed us from the post-mortem held by order of the coroner. In low-power view (fig. 1) the nerve presents no obvious abnormality. The epineurium, perineurium and endoneurium are within normal limits of thickness and there is no obvious infiltration. With higher magnification it is seen that the vessels are engorged, and that here and there a small venule has some lymphocytic infiltration around it (fig. 3), but this is very rarely

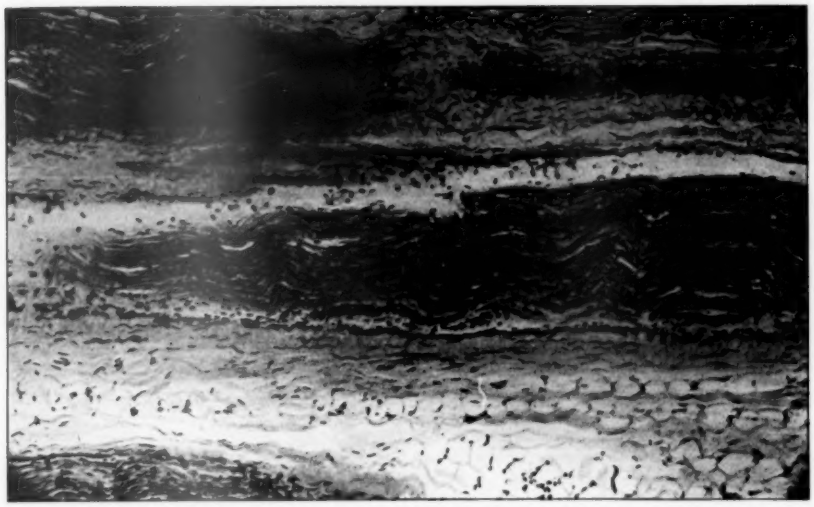


FIG. 2.—Longitudinal section of sciatic nerve showing exudate under the perineurium.

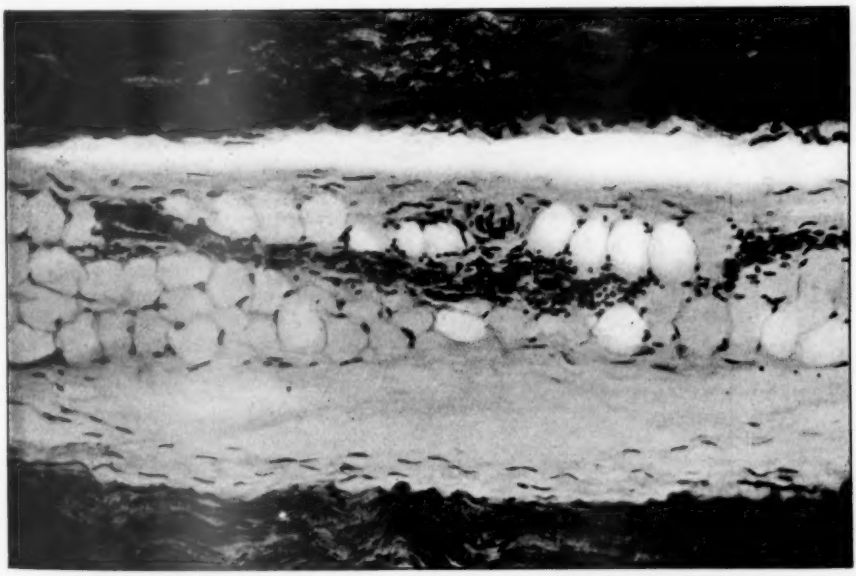


FIG. 3.—Longitudinal section of sciatic nerve to show lymphocytic infiltration around a small venule. Although the perineurium was not lifted at this point, the region drained by the venule was affected.

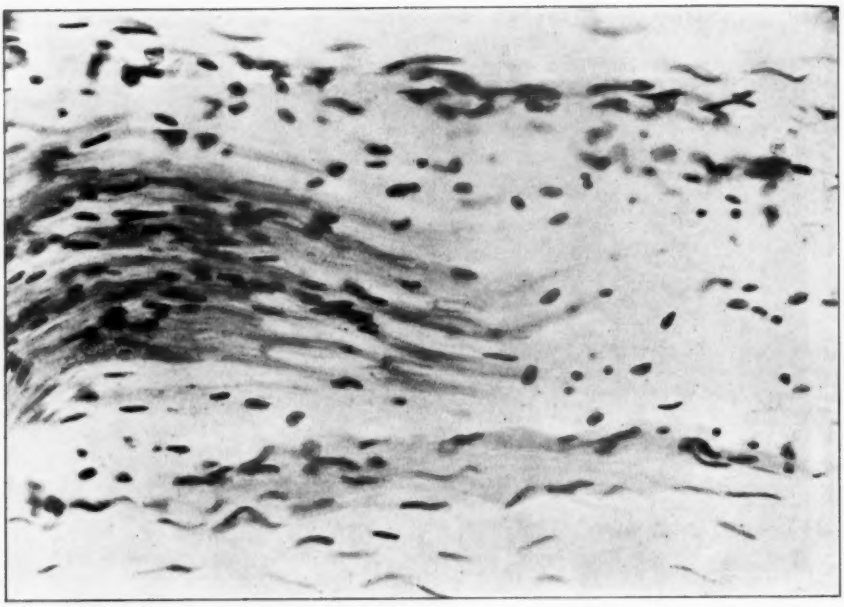


FIG. 4.—Tangential section of affected nerve bundle, to show the exudate and its content of endothelial cells and lymphocytes.

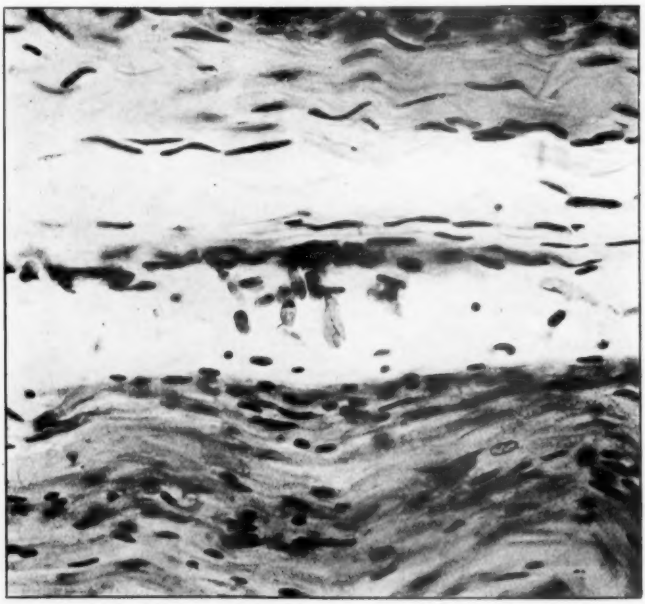


FIG. 5.—The lifting of the perineurium and proliferation of endothelial nuclei immediately underlying it are seen. The nerve-fibres showed no evidence of affection, apart from the presence of an occasional lymphocyte between them.

encountered. The perineurium is in places shrunken and fissured by post-mortem artefact, but careful examination reveals that in about one-sixth of the nerve fasciculi the perineurium is separated from the nerve-fibres on one side, rarely all round, by an exudate containing occasional lymphocytes and, rarely, a wandering endothelial cell. From the clotted appearance of this exudate it would seem that shrinkage following fixation is responsible for lessening its apparent amount. The nerve-fibres appear to be undamaged. Careful examination reveals no evidence of Aschoff nodules. The perineurium and endoneurium do not appear to be thickened. These areas of œdema are very apparent in longitudinal sections of the nerve (figs. 2, 5), especially where a nerve fasciculus is cut tangentially (fig. 4), and here the exudate is seen to be between the perineurium and the endoneurium, in a space which is lined with large endothelial nuclei. This space, which I have found filled by œdema in other forms of chronic polyneuritis, does not appear to communicate with the veins or with lymphatics in the nerve and I have found by injection of fresh normal nerves that it can be filled with gelatine-carmine along great lengths of nerve without the use of any considerable injection pressure. It is crossed by small vessels passing to and from the fasciculus and these have an endothelial sheath where they cross the space.

It seems certain that in some chronic forms of polyneuritis in which great thickening of the perineurium and endoneurium occurs, this is derived from the organization taking place in the exudate under the perineurium.

The vascular engorgement in the case quoted may, of course, have been due in part to the oxygen injection, which presumably causes collapse of the larger veins, and thus produces a passive hyperæmia. It is this effect in causing passive hyperæmia which in my opinion gives the rationale of oxygen and saline injection.

The unfortunate termination of this case, though in all probability not related directly to the oxygen injection, leaves one with the reflection that purely subcutaneous injection has less risk than deep, and can, apparently by collapsing superficial veins, cause sufficient vascular hyperæmia to achieve results.

The discrepancy between the degree of enlargement of the nerve and the subsequent histological appearance is evidently due to the high water content of the exudate. Acupuncture, as described by Dr. Martin, would possibly give opportunity for this exudate to drain into the connective tissue spaces if the perineurium were actually ruptured. Even if the perineural spaces were much more distended than their histology would suggest, their efficient tapping by needling would appear to be difficult. The drainage of these spaces appears to constitute the chief problem of the treatment of this form of neuritis for, without doubt, organization of the exudate can and does occur as the disease becomes chronic.

Section of Odontology.

President—A. E. ROWLETT, L.D.S.E.

[*February* 27, 1933.]

Evidence regarding the Different Types of Periodontal Disease.

By F. N. DOUBLEDAY, L.R.C.P., M.R.C.S., L.D.S.Eng.

A STUDY of recent literature shows that the diversity of opinion regarding the nature of chronic general periodontitis is as great as it has always been since the disease first attracted careful attention. Broderick in his Cartwright Prize Essay upon the subject, endeavours to define what he means by "pyorrhœa." Colyer and Sprawson, in the latest edition of their textbook, use the term "paradontal disease"; the term "para" being given in the Greek Lexicon as "beyond or beside" which does not appear as exact a term as the prefix "peri" meaning "around." The major proposition which it is desired to make is that "periodontal disease" or "pyorrhœa" is not one disease but that separate varieties can be distinguished and that such recognition greatly facilitates treatment. The pathology of periodontal disease is to-day much in the state in which "chronic rheumatism" was twenty years ago when a variety of processes were lumped together which are now recognized as being some infective, some due to deficiency diseases, etc.

The term pyorrhœa is applied as a matter of convenience to a disease of the supporting structures of the tooth; it does not of necessity mean a flow of pus. Some recent views regarding the initial break in the gingival epithelium require comment. Gottlieb [1] considers that the gingival epithelium is continuous with the epithelium of the enamel organ and that the primary change in paradental pyorrhœa is a process of continuous eruption of the tooth, associated with a downgrowth of epithelial tissue separating the periodontal membrane from the tooth. Warwick James and Counsell [2] state that the initial lesion "is associated with a deposit of materia alba and calculus upon the teeth." Broderick [3] considers that "the gingivitis resulting from the irritation of subgingival calculus will lead to a formation of pocket that is in every way dissimilar to that caused by simple irritation, such as stagnating food will bring about."

[1] Gottlieb, B., "Schmutzpyorrhoe, Paradentalpyorrhoe und Alveolaratrophie," Berlin, 1925.

[2] James, W., and Counsell, A., *Brit Dent. Journ.*, 1927, xlviii, 1237.

[3] Broderick, F. W., Cartwright Prize Essay, London, 1931, p. 10.

In this matter much depends upon the general principles upon which all pathology rests. Surely the answer to this question must be that a crowded condition of the teeth leads to food becoming wedged in the inter-proximal spaces. This food, by pressure, causes congestion of the interdental papilla, just as a filling with overhanging margins, or the pressure of a temporary filling bitten down on to the gum margin will do. This venous congestion leads to a sodden epithelium, which is easily damaged and rubbed away by any slight traumatic injury, such as friction of hard food or a tooth-brush; then the proteolytic strains of mouth organisms, already growing in the food débris, gain a hold upon the submucous connective tissue and growing there, initiate the disease. On any surface irritated by toxins epithelium will proliferate; its growth in the periodontal pocket is a similar pathological change to that seen in the growth of epithelium upon the margins of a chronic varicose ulcer. So, too, the deposit of calculus described in the paper by Warwick James and Counsell is only the early demonstration of the well-established fact that any body fluid kept in a stagnant area tends to throw its lime salts out of solution. Proteolytic micro-organisms multiply and gain a footing in the connective tissue of the periodontal membrane, gradually liquefying it, so that the pyorrhœa pocket is produced. The absorption of toxin from this badly drained pocket eventually causes destructive changes in the bone and root of the tooth. Osteoclasts are formed in the periodontal membrane; the compact bone lining the tooth socket is first destroyed, then the cancellous bone of the alveolar process is decalcified, and finally its organic collagenous matrix is peptonized and destroyed. Similarly the root of the tooth is absorbed; if the pulp is alive it will frequently react to injury, causing areas of calcification of the dentinal tubes, and giving rise to translucent zones in the roots.[4] There is a type of chronic periodontal disease which is characterized by a flow of pus from the pockets. This is a reaction to injury caused by organisms producing a positive leucocytosis. If material from the pocket is grown upon glucose broth and blood-agar, a mixed growth, in which staphylococcal colonies predominate, usually results. Occasionally a virulent strain of streptococcus is present in the pockets; clinically this type of infection is of serious import. Quite often there is very little leucocytic reaction or pus to be seen.

Fuso-spirillary infection of the gum margin is a definite clinical entity. It is due to the growth of large numbers of *Spirochæta dentium* in association with smaller numbers of fusiform bacilli. Under dark-ground illumination the fusiform bacilli are seen like battleships at anchor, with numbers of spirochætes wriggling and twisting all round them. When fixed and stained with carbol-fuchsin, the fusiform bacilli present granulated bodies surrounded by a capsule which does not take the stain. They often have an appearance of one dividing into two. The spirochætes have several curves in their bodies. Clinically the type of chronic general periodontitis with which they are associated presents an intensely vascular inflammation of the gum margin, which bleeds freely upon pressure; pus is seldom seen. The toxins increase the vascularity of the part, but do not exercise a positive chemiotaxis producing pus visible to the naked eye. These organisms grow where they are partly shut away from the air, and where there is a good supply of blood-serum. The depths of gum pockets and places where dentures are pressing heavily on the gum margin are two points where these conditions exist. The fact that they do not like an oxygen-free atmosphere is shown by the treatment of this type of periodontal disease.[5] The chromic acid and peroxide of hydrogen produce chromium sesquioxide, which liberates oxygen freely and produces an atmosphere in which the organisms cannot grow. Excessive smoking, especially cigarette smoking, favours

[4] Colyer, Sir J. F., "Chronic General Periodontitis," London, 1916.

[5] Doubleday, F. N., *Proceedings*, 1927, xxi, 139 (Sect. Odont., 5).

this type of disease. Stones,[6] in a survey of cases of pyorrhœa alveolaris, states that he found these organisms in direct smears, and gives the opinion that they are usually the predominant organism present. It is the experience of the present author that fuso-spirillary infection is predominant in a limited number of cases, but that where present it is extremely susceptible to treatment by oxidation. It is to be regretted that this condition has been so little followed up since it was originally described by the present author[7] in 1921 and again in 1927. There is a variety of evidence regarding the general pathogenicity of these organisms. Worster-Drought[8] has recorded a fatal case of meningitis which followed a fuso-spirillary infection in the mouth. Heffernan[9] records four cases of acute bronchopneumonia following tooth extraction, where fuso-spirillary infection was the agent principally present. Other organisms have been described as causative factors. Bass and Johns[10] in 1917 described a protozoal organism, *Endamœba buccalis* as the cause of pyorrhœa. In the opinion of the present author[11] the presence of amœbæ indicates the presence of waste food, and shows that the patient is not cleaning his teeth successfully. Its presence in direct films is therefore a useful indication, but it does not appear to have any pathological significance. The belief that a thread organism—*Leptothrix buccalis*—is responsible for the condition by the formation of a black deposit of calculus was advanced by Helen Gooderich[12] in 1917. Arthur Bulleid[13] showed that all kinds of calculus may be formed in cats, as the result of the growth of this organism in their mouths.

In the infective types, by the ordinary processes of scaling and cleaning, combined with drug treatment of the pockets and, when necessary, by the removal of a tooth, drainage may be provided; in other cases the insertion of an inlay bridge, by restoring function, will make a given area healthy. In the majority of cases the disease will be arrested for many years if these conditions are correctly studied and treated. It is, however, found that some patients fail to respond to local treatment as clinical experience shows that they should do. The practitioner must then consider why it is that local measures are failing to give relief, and whether an altered condition of the body as a whole is not responsible for local failure to resist infection. This line of observation has been followed out by the writer previously.[14] A number of factors may have this effect. Many years ago Sir Arbuthnot Lane first taught that if the passage of food through the bowel is delayed, abnormal fermentation of food will occur, toxins and food ptomaines will be absorbed, and the patient's general health is lowered. As a result, gum infection may occur. Fundamentally, the observations of Lane are as accurate to-day as ever, although advancing knowledge has led to medical, in place of surgical, treatment of the condition. It is absolutely true that under modern conditions of life in England many people eat too much, mix too many varieties of food at one time, and do not take enough physical exercise in the fresh air to burn up the food they have swallowed. Whether this is occurring or not

[6] Stones, H. H., *Brit. Dent. Journ.*, 1932, liii (i), 499.

[7] Doubleday, F. N., *Brit. Dent. Journ.*, 1922, xliii, 1153; *Proceedings*, 1927, xxi, 139 (Sect. Odont., 5).

[8] Worster-Drought, C., *Brit. Dent. Journ.*, 1918, xxxix, 377.

[9] Heffernan, P., *Lancet*, 1932 (ii), 734.

[10] Bass, C. C., and Johns, F. M., *Journ. Amer. Med. Assoc.*, 1915, lxiv, 553.

[11] Doubleday, F. N., *Dent. Mag. and Oral Topics*, 1929, xlvi, 972.

[12] Gooderich, H., and Moseley, M., *Dental Record*, 1917, xxxvii, 182; *Journ. Roy. Micros. Soc.*, 1916, 513.

[13] Bulleid, Arthur, *Brit. Dent. Journ.*, 1925, xlvi, 289.

[14] Doubleday, F. N., *Brit. Dent. Journ.*, 1928, xlix, 468; *Dental Record*, 1931, li, 398.

must in the first place depend upon a consideration of the occupation, diet and habits of the patients, and upon the observation of their general condition. A pendulous abdomen, a sallow skin, a pale conjunctiva, a pulse which is full and bounding or of poor tension, a furred tongue, complaints of lethargy and headaches are all evidence of this condition. What mouth signs are found in association with it? The skiagrams of Case A illustrate one aspect of such a case. The patient's dentist had condemned her to a wholesale extraction of teeth, and the doctor, not agreeing with the diagnosis, referred the patient for a second opinion. I knew nothing of the conclusions previously reached until I had examined the case and formed my own opinion. The skiagrams show a uniform superficial absorption of the alveolar bone without decalcification occurring in the deeper structures. There was a complete absence of local inflammatory reaction. The patient's general condition suggested delayed action of the bowels. Inquiry showed that she had been very constipated for several years, habitually taking half a dozen cascara sagrada pills daily without relief. Her saliva pH was 8. Correct treatment of her bowels has effected marked improvement; the wholesale removal of her teeth for a supposed "pyorrhœa" would have made her worse.

Broderick[15] has advanced the view that pyorrhœa occurs in alkalosis. The cases under the writer's care do not support this view. Broderick in his books quotes evidence to show that the reaction of the saliva indicates the general reaction of the body fluids. The following cases are of interest in this connection.

Mrs. B., aged about 35, presented for treatment on January 26, 1931. She had a septic type of chronic periodontitis, cultures yielded a mixed infection in which staphylococcal colonies predominated. She complained of muscular pains in the lumbar and scapular regions. She was not constipated and seemed to be moderate and careful in her diet, except that she was unduly fond of condiments and took very little fresh milk, butter or fruit. Her saliva pH was 4·5. It was interesting to note that in spite of the acid reaction she had a good deal of calculus upon her teeth. She was instructed to rectify the defects in her diet and to carry out steady breathing exercises. She has carefully followed this out, her general condition is greatly improved and her mouth condition is much better. On November 8, 1932, her saliva pH was 8. The method the writer employs for these saliva reactions is to put 50 c.c. of distilled water into a beaker of alkali-free glass and ask the patients to take a mouthful and to hold it in the mouth for five minutes; during this time they can only breathe through their noses and hence the admixture of expired carbon dioxide with the saliva must be very small. At the end of the time, the patient puts it into the beaker, 5 c.c. is put into an alkali-free test tube and 5 drops of B.D.H. indicator are added and the colour is estimated. The result can only be an approximation, but it is a method which the clinician can employ.

Broderick believes that the health of the body, and hence the tendency to chronic periodontitis, depends upon the ductless glands, which he divides into two groups. The catabolic group, which includes the thyroid, suprarenal medulla and posterior pituitary, and an anabolic group, parathyroid, thymus, suprarenal, cortex, and anterior pituitary. He considers the tendency to chronic periodontitis to be due to a delicate lack of balance between these groups. The knowledge of this subject is at present in a very experimental state. It seems safer to try to put the body into as sound a state of health as possible and then to leave the ductless glands to make their own balance. A Chinese philosopher, Laotzu (200 B.C.), wrote thus: "The infant's bones are weak, its sinews are soft, yet its grasp is firm. All day long it will cry without its voice becoming hoarse. This is because the harmony of its bodily system is perfect." We may add that this is a physiological balance and by our treatment we must endeavour to return our patients to it.

15 Broderick, F. W., "Dental Medicine," London, 1928; "Pyorrhœa Alveolaris," London, 1931.

The calcium of the body is in part fixed calcium, stored in the bones and teeth, and in part ionic calcium in blood, normally 10 milligrams per 100 c.c. It is present partly as fixed calcium in an inactive form in combination with protein, the amount present being directly proportional to the amount of protein present; the remainder is inorganic calcium, which is present largely as phosphate and carbonate, which give rise to the active calcium ions of the blood. In prolonged infective processes the lime salt is also reduced.[16] This observer considers that with an abnormally high ionic calcium in the blood there is a deposition of lime salts, as seen in the proliferative types of arthritis and that when the ionic calcium of the blood is low, absorption of the bony tissues occurs, as is seen in many varieties of periodontal disease. A small addition of certain substances termed "buffers" has a marked effect in preventing change of the acid-alkali balance, in blood as in other fluids. Sodium bicarbonate is one such buffer substance; phosphates, citrates, borates and acetates have the same effect. Normally the body fluids have a constant pH reaction of 7·5 and vary little from this point, but in some infective processes, when imperfect metabolism is occurring and in some conditions of nephritis, an acid state of the body fluid occurs. There is other evidence that the body being short of lime salt will utilize the fixed lime salts of the body to supply a deficiency of basic salts.[17] The following case bears strongly on this point.

Mr. A., aged 53, came to me on November 8, 1927. Only six lower front teeth remained, and they were so loose that I had no thought of saving them until he told me that his great pleasure in life consisted in amateur acting. Had these teeth been sacrificed, his chance of playing speaking parts would have been slight. I therefore investigated the case afresh. Cultures and direct smears taken from the gum-pockets on November 8 and again on November 16, 1927, showed the customary type of mouth infection—mixed staphylococci and diplococci in the cultures and a moderate number of leptothrix and of mouth spirochætes in the direct smears. The patient was most careful to keep his teeth regularly cleaned. His general history recorded many years of chronic indigestion, with latterly some "arthritis" of the right hip, and similar symptoms in the left hip and right shoulder, less severely marked. The general character of the case suggested that the hope lay in improving his general calcium metabolism. Collosol calcium (Crookes) a dessertspoonful twice daily and parathyroid gr. $\frac{1}{30}$, one tablet to be taken with each dose of calcium, were prescribed to activate the calcium. The use of an activating agent needs no comment. Physiologists have shown that lime salts are not only present as fixed salts in the bones and in the teeth, but that their presence is essential for the normal function of the tissue cells. In the blood they circulate in the ionic form. Calcium is taken in food—in milk, yolk of egg, green vegetables, and in other ways. Dixon showed that the administration of lime salts alone by the mouth resulted in the excretion of a corresponding amount of lime salts in the fæces. Later investigation has shown that for proper deposition of calcium in the bones, not only is it necessary for a proper proportion of calcium and phosphorus to be present in the diet but certain accessory substances are also necessary. In the study of tetany it has been shown that extirpation of the parathyroid glands is followed by a lowering of the blood calcium and a raising of the blood phosphorus.[18] In the treatment of this case (Mr. A.), parathyroid was used in the belief then (1927) existing that the administration of parathyroid would raise the ionic calcium of the blood and so stop the wastage of fixed lime salts from the tissues. More recently it has been shown that parathyroid increases the ionic blood calcium by removing the pathologically combined calcium

16 Price, Weston, "Dental Infections, Oral and Systemic," Ohio, 1923, i, 540,

17 Warner, E. C., *Lancet*, 1930 (i), 339.

18 Wright, Samson, "Applied Physiology," London, 1931, p. 132.

in the body. It is now better practice to utilize vitamins A and D, administered as actual sunlight, artificial ultra-violet radiation, or as cod-liver oil or radiostoleum. This activation of the calcium seems clinically to make a great difference to these patients. An interesting point is whether it is not wise to begin treatment by a course of a month or six weeks of parathyroid in order to bring the pathologically combined calcium into solution and then to continue treatment with calcium combined with an activating agent.

Section of Epidemiology and State Medicine.

President—WILLIAM BUTLER, M.B.

[*May* 26, 1933.]

The Ventilation, Heating and Lighting of Hospital Wards.

By JAMES WATT, M.D.

ABSTRACT.—*History* of ventilation in last 100 years, showing reversal of ideas and influence of sanatorium idea.

Physiology of cool moving air. How it affects metabolism, heat-loss and heat-production. Relation to sunlight. Reactive capacity of the individual.

Practice of these teachings, as illustrated by sanatorium treatment of tuberculosis and by open-air schools. Exposure to cooling air a powerful therapeutic agent. Infrequent occurrence in sanatoria of diseases or complications often ascribed to cold. Dilution of infection. Applicability to diseases other than tuberculosis. Shock and old age.

Perflation and diffusion, their relative values. Uniformity or variability of effect desirable? Incompatibility of good ventilation and ordinary standards of heating. Former the more important. Conclusion that ward temperatures may be lowered without harm. Measures necessary to compensate, clothing, classification of patients, small wards. Changing standards of comfort. Psychological effects.

Systems of ventilation in hospital wards. Mechanical by propulsion or extraction being displaced by natural system, usually by cross-window ventilation. Supplementary ventilators. Objection to heating of incoming air. Fallibility of human factor in management. Sash versus casement windows. Hoppers. Austral window. Orientation and exposure of wards. Ventilation of small wards. Proportion of window space to solid wall. Balconies. Floor space.

Heating of wards. Heating of air or floor or walls. Open fires. Value of radiant heat. Steam or water under low or high pressure. Radiators or pipes.

Lighting. Avoidance of glare from windows. Arrangement of beds in wards. Colour of walls. Blinds and curtains. Artificial lighting.

IT is commonly assumed that the ventilation and heating of tuberculosis sanatoria are peculiar to that type of hospital and have little application to general and fever hospitals, whose conditions are supposed to be different. It is important to try to determine whether this assumption is correct or whether the same principles, the application of which produces such striking results in tuberculosis institutions, should not also be applied in equal degree, or at least to a greater degree than at present, in general medical and surgical hospitals, and in fever and other special hospitals.

At the outset it is necessary to refer briefly to the recent history of the science of ventilation and the medical theories bearing on it. To do so will at least suffice to show how much is yet to be learned, and how little we can claim for the finality of our present views. It is less than a hundred years since Dr. Bodington, of Sutton Coldfield, was protesting against the antiphlogistic lowering methods of treatment and the practice of shutting up the sick in closed rooms. Air was then regarded as a dangerous element to be kept away from wounds. Cold air on the skin or in the lungs was particularly to be avoided by the sick. The idea—then firmly rooted—that many illnesses were caused by a chill, survives to some extent even now as a cloak for our ignorance. Lister's antiseptic sprays and the generally held theories about the conveyance of infections by the air continued to prejudice men's minds against the atmosphere surrounding them. With the development of hygiene as a science, there grew the idea that the air to be breathed by the sick must be filtered, warmed, and moistened, delivered to them without draught and without excess of carbon dioxide or organic emanations. Such views encouraged the use of mechanical systems of ventilation. Then the sanatorium idea of the treatment of at least one disease in the open air began to take root in England half a century after it was first preached. Along with this the work of Flügge, Haldane and Hill,

on the physiological action of moving air completed the revolution. Now we have reached the stage when mechanical systems of ventilating hospitals and schools are being scrapped and natural cross-ventilation holds the field. Carbon dioxide, so far from being dreaded, is now used to stimulate respiration. Such a rapid succession of different views makes one wonder what the position will be in the course of another generation.

The existing standards of ventilating and heating hospital wards are determined very little by medical considerations, but are based on the habits of the community generally in regard to clothing and the temperature at which living rooms are kept.

Although medical practitioners and nurses are taught a little about the place of ventilation in hygiene, yet relatively it is a neglected subject. After the architect and the builder, guided perhaps by medical advice, have settled the form and degree of the ventilation of a general hospital, it is seldom that anyone takes any serious interest in it thereafter. In a fever hospital questions of cross-infection and dilution of infection compel greater attention to the ventilation of the wards, but it is only in tuberculosis institutions that ventilation gets consideration as the therapeutic agent which it undoubtedly is.

Before discussing the practical aspects of the question, we ought to consider what good ventilation is and what it does. It may be taken as proved that within fairly wide limits the chemical purity of the atmosphere, its content of carbon dioxide or oxygen or organic matter, are of much less importance for health than certain physical factors which influence the loss of heat from the human body. Life would be impossible without the faculty of shedding heat. The three chief ways in which the body gets rid of heat are by conduction and radiation to the colder medium surrounding it, by evaporation of moisture, visible or invisible, from the skin, and by warming the expired air and evaporating moisture from the respiratory membranes. Increase of heat-production within the body, as in muscular exertion or in pyrexia, is followed almost immediately by increased heat loss, and incidentally by increased consumption of food and oxygen or alternatively by loss of body-weight. Conversely, increase of the heat loss stimulates heat-production, calling for more food and oxygen, increasing appetite and the excretory processes. I may quote as an example the statement of Hill and Campbell[1] that the metabolism of children lying nude in the open air in summer at Alton was 50% above the standard figures for closed chambers, and in Switzerland the metabolism of children lying nude and exposed to the open air was sometimes increased over 100% when there was snow on the mountains. The same authors state that cool conditions, e.g., sleeping out of doors, double the evaporation of water from the respiratory membranes.

Much importance is now being attributed to the effect of sunlight on health and on such diseases as tuberculosis and rickets. Patients who are being deliberately treated by light, artificial or natural, have at the same time a large area of skin exposed to the air, and I am not sure that a large part of the beneficial effects observed is not due to the latter factor. Exposure to bright sunlight without movement of cool air may be the opposite of beneficial in many persons.

To obtain benefit from good ventilation a certain reactive or regulating capacity is demanded of the organism. In certain states of health, particularly in shock, this power of response is grossly defective, and in certain conditions of civilization it is rendered sluggish through partial disuse, but it can be affirmed that in the great majority of both the healthy and the sick, it is perfectly adequate or is easily capable of re-education. The problem of ventilation is the problem of utilizing this powerful exciter of metabolism within the limits of the reactive capacity of the individual. It does not, I presume, require arguing in these days that increase of metabolism, causing increased intake and assimilation of food and oxygen, is the

[1] Hill and Campbell, "Health and Environment," p. 200.

best means of repairing damaged or unhealthy organs or tissues and of securing the elimination of the ultimate waste products and the products of bacterial action. This, of course, is almost the exact contrary of the "lowering" methods of treatment by bleeding, purging, and antimony tartrate, so long in vogue.

How these principles of physiology are put into practice is best illustrated by the sanatorium treatment of tuberculosis. Here are patients of all ages, suffering from acute or chronic forms of a bacterial disease affecting chiefly the respiratory organs, but also the bones, joints, glands, kidneys and peritoneum. It has been well established now for over thirty years that the various forms of this disease, no organ being excepted, are best treated under what may be called open-air conditions, conditions where the temperature surrounding the patient is of relatively little importance, so long as he is exposed to moving air, producing a cooling effect. The increased heat-loss stimulates heat-production within the body, and increases appetite considerably. This great principle, along with the equally important one of rest for the diseased organ, is the basis of sanatorium treatment, and produces remarkable results in reducing toxæmia, improving nutrition and causing retrogression of the disease deposits. Can methods which produce such results in one multiform disease not produce equally remarkable results in other diseases? Are we failing to utilize in the latter a factor which would accelerate recovery? Is improvement in nutrition and general health not equally desirable in the patient recovering from gastro-enterostomy or diabetes or diphtheria?

It is true that sanatorium practice in recent years has changed somewhat in the direction of providing greater comfort for the patient. Exposure to the open air is less drastic than it used to be, and more provision is made for heating wards. Simultaneously the practice in general hospitals has tended to move in the opposite direction, to provide fresh air at a lower temperature than was formerly thought necessary. There is still, however, a very wide gap between the two for which it is difficult to find sufficient justification.

Abundant ventilation in open-air hospitals is not synonymous with draughts. Sir Henry Gauvain has shown in his new buildings at Alton how the completest exposure to fresh air and sunlight can be combined with necessary warmth and comfort. Draughts are not essential in sanatorium treatment, although in moderate degree they do no harm. The fear of cold is deeply rooted in people's minds, and certain diseases are particularly associated with exposure to cold, mainly perhaps because of the chilly feelings which usher them in. Pleurisy is such a disease. Naturally it occurs frequently in sanatoria because it is part and parcel of pulmonary tuberculosis, but it occurs in my experience just as frequently in summer as in winter, and more frequently in the patient's own home than in a sanatorium.

Lobar pneumonia is practically unknown in sanatorium practice. In an experience of twenty years and covering about 12,000 sanatorium cases, I cannot recollect a single case of lobar pneumonia among them. Yet in the early weeks, at least, of their sanatorium treatment, there must have been among them as high a proportion of pneumococcus carriers as in the general population from which they came. They were plunged into the ordinary conditions of exposure to sanatorium weather without any mitigation or gradual acclimatization. They ranged from 15 to 65 or more years of age. The initial discomfort which they often feel in winter generally disappears quickly, and their symptoms of illness as a general rule begin to ameliorate from the time of admission.

Bronchitis is occasionally aggravated by sanatorium conditions in winter, but more frequently improves steadily with the improvement in both the general health and the tuberculous disease. Colds in the head occur in sanatoria in very small epidemics when infection is introduced from without. Neither the general nor the local symptoms are any worse under sanatorium conditions in winter than in an ordinary household. Where the coryza is complicated by tracheitis or bronchitis,

this occurs no more frequently and takes no longer for recovery in patients nursed in open-air wards even when the temperature ranges somewhere between 30° and 50° F. than in patients nursed in their own homes at much higher temperatures and with much less exposure to moving air. It seems that it is less the low air temperature that aggravates the symptoms of a coryza than alternations of high room temperature and low external temperature in winter.

Chilblains occur fairly frequently in winter and may be uncomfortable, but such a trivial complication cannot be set against the great benefit which the open-air régime confers on the health of the patients. It is no part of sanatorium treatment to keep its patients uncomfortable. If they are, it indicates some avoidable failure on the part of the staff or of the patients themselves.

Rheumatic conditions, so often associated in the minds of the public with cold, are occasionally complained of by patients. Only twice, I believe, have I seen subacute rheumatic fever develop among my patients, and I suspect that rheumatism in its various forms is less common in sanatoria than among the general population. In two children's hospitals with which I am acquainted tuberculosis and acute and subacute rheumatism are treated under almost similar conditions in regard to ventilation and heating. In the acute stages the rheumatic cases are treated in freely ventilated and only moderately warmed wards, and in the convalescent stages either on open balconies or verandahs, or in wards identical with those for tuberculous cases.

In regard to the infectious diseases, spread mostly by spray infection, the degree of ventilation in sanatoria so dilutes the infection that it is rare for an epidemic to gain more than a very small footing. During the recent epidemic of influenza 1% of my patients and 25% of my staff were affected. The all-important part that good ventilation plays in preventing cerebrospinal meningitis in barracks is well known to you.

If, then, one is justified in claiming so much benefit to the general health, and such an absence of adverse effects from the degree of ventilation practised in sanatoria and open-air schools, the question ought to be discussed how far the same practice is likely to have similar results in other disease conditions. In certain fever hospitals such treatment is already being given to convalescents with excellent effect. In children's hospitals, too, there is a greater tendency to expose patients on balconies and verandahs, perhaps more for treatment by sunlight than by fresh air. In the earlier part of this century a good deal was written about the value of open-air treatment of cases of pneumonia and the most conflicting opinions were expressed. For example, G. D. Head,[1] from an experience of American military hospitals in war-time records a mortality of 13·9% among cases of influenzal pneumonia treated by open-air methods, and 3·2% among those treated in closed and warmed wards. But it is clear that the open-air methods were unduly drastic, and further the first figure was obtained during the early part of the epidemic when one expects a higher mortality, and the second figure in the later part of the epidemic. Oskar Kudelka[2] on the other hand obtained much improved results by treating pneumonia in infants by open-air methods.

Cases of cardiac disease have been treated in recent years by several physicians on open-air lines. On theoretical grounds one would expect benefit in such cases, since cool air playing on the skin improves the cardio-vascular tone, and by contracting the skin vessels and keeping the blood-supply mainly in the internal organs lessens the strain on the heart, while improving oxygenation and metabolism.

Exposure to cold has generally been regarded as one of the causes of nephritis, hence one would be chary of departing from orthodoxy in treating this disease or a disease like scarlet fever, with a marked tendency to be complicated by it. But in

[1] *Journ. Amer. Med. Assoc.*, 1919, lxxii, 1268.
[2] *Wien. Med. Woch.*, 1932, lxxxii, 969.

all those diseases in which the authorities recommend warmth and a constant room temperature, they also advise free ventilation, although without draughts. There are those who deny any special relationship of cold to nephritis.

Cases of surgical shock following operation or burns or laceration of tissues appear to be in a class by themselves. The lowered blood-pressure does not seem to depend on vasomotor paralysis, and the usual response of the vasomotor system to the stimulation of cool air is lacking. Similarly very old and very feeble patients have poor reactive capacity, and should be treated under warm sheltered conditions.

With these few exceptions I submit that something approaching sanatorium conditions would be to the advantage of the great majority of hospital patients. Who would not agree that increase of appetite and improvement in the condition of the blood, effects which almost invariably follow exposure to the open air, would not also be of value in the majority of medical and surgical diseases? Pyrexia is no contra-indication, but is rather an indication for it. The provision of balconies and verandahs, although making such treatment easier and pleasanter is by no means essential, and unless well planned may be a disadvantage.

It seems a little absurd that patients of all ages and degrees of infirmity, and suffering from a great variety of diseases, should receive identical treatment in respect of the very important medium enveloping them. In the large wards which have been favoured in England, the ventilation must necessarily be a compromise determined like the strength of a chain by the weakest link. It seems reasonable to provide the treatment most suitable to the needs of the individual, and I suggest that this could best be secured by providing a higher proportion of accommodation in small wards, in which selective treatment would become possible.

Diffusion of air alone, although with large openings it may be sufficient to keep the chemical composition satisfactory, is nevertheless not enough for good ventilation. It does not as quickly as is necessary remove the layer of heated air in contact with the skin. For this some movement of the body of air is required. Air in uniform movement, causing monotony of sensation, is regarded as less stimulating and beneficial than air varying in velocity, and possibly also in temperature. Slow mass movement with such small variations, "puffs of air this way and that," provides better ventilation than strong currents of air coming through small openings and causing marked local cooling. The most comfortable and at the same time probably most efficient ventilation is secured in a shed or room of which one side is completely open, while the other three sides, although provided with fanlights, can be completely closed. On windy days the velocity of the moving air is reduced to reasonable limits, whether the open side is towards or away from or oblique to the direction of the wind. On still days free diffusion plays the chief part, aided by such cross movements as can be secured between the open front and one or more fanlights in the opposite wall.

The cooling effect on the body which is desired is attained either by the coldness of the air or by its movement. Cold still air does not long remain cold in contact with the warm body, hence in practice it is the movement of air at a temperature below that of the body temperature that matters most in regard to ventilation. A greater velocity of movement is naturally required the higher the air temperature. With really cold air a little goes a long way to provide the conditions of good ventilation, and protection from too great velocity becomes important. Such protection out of doors is of course provided by increasing the clothing. Indoors it is generally attained by cutting down air movement, for example, by closing windows. Our problem is to secure such a degree of movement of the air as will stimulate metabolism by abstraction of heat from the body, without interfering with the patient's comfort to such an extent as to depress his vitality by excess of heat-loss or to excite in him a hostile mental attitude which would tend to counteract the benefit of the treatment.

It follows from my argument that there is essentially a conflict between good ventilation and good heating as ordinarily understood, indeed that the two are incompatible in practice. Usually the ventilation is sacrificed to the temperature of the ward, but I hold that the ventilation should be the first consideration and that the ward temperature is a secondary matter. The old standards of ventilation handed down from one textbook to another, and based mainly on the carbon dioxide content of the air and on the standard of comfort demanded, required that the air of a room in which each person had 1,000 cubic feet of air space be changed at least three times an hour. Rosenau states that air moving at a greater velocity than 1 to 2½ miles an hour, that is 1·5 to 3·5 feet per second, according to the outside temperature, causes the sensation of a draught. If the whole body of air in a room were moving at even the smaller of these velocities, it would be changed at least one hundred times an hour. The latter standard corresponds much more closely than the former to the conditions under which tuberculous patients thrive and get well.

One has to consider the psychological effect of any form of treatment on the patient. A continuous stream of unpleasant sensory impulses is not likely to conduce to recovery any more than continuous pain. Children are little affected in this way, and stand exposure to cold remarkably well, as can be seen both among healthy children and among ailing children in open-air schools and hospitals, where the amount of clothing required is surprisingly small. Comfort has to be studied rather more in the adult. But what may at first be regarded as discomfort is soon borne cheerfully and without any harm if the patient is satisfied that thereby his ultimate good is going to result. It has to be emphasized that exposure to cool air is a mode of treatment and that the body adapts itself very quickly to such a change of conditions.

In this country it is generally held that the ward temperature should be between 60° and 65° F., the optimum temperature for comfort being 62° F. In America the standard demanded for comfort is generally higher, even as high as 70° to 75° F. Obviously these figures are partly dependent on habit. The view now advanced is that ward temperatures can be reduced below those standards not only without harm to most patients, but actually with benefit to their general health and the rapidity of their recovery. Naturally, adjustments in other directions would have to be made. Extra blankets, warm bed jackets, bed socks and gloves and, in a few cases, woollen helmets would have to be available for need. The dietary would probably have to be increased to meet the increased metabolism. Patients would have to be better classified than at present. Those requiring more shelter and warmth would have to be segregated in small wards.

Mechanical systems of ventilation by propulsion and extraction of air have many attractive features where equable conditions of temperature, humidity and velocity of air movement are desired, as in an operating theatre or a place of entertainment, but in hospital wards, where equable conditions are unnecessary and possibly undesirable, they have quite gone out of fashion both in England and abroad. Whatever system of ventilation is used, it is less frequently the equipment than the human management of it that is faulty.

Most hospitals now depend on cross-ventilation of wards by windows, often combined with the ventilating effect of open fires or stoves, and sometimes with wall ventilators opening behind radiators. Tobin's tubes and Sherringham's valves survive in old buildings and in the textbooks. Fireplaces or stoves in the middle of wards have mostly gone also, not because of inefficiency, but because of their obstructiveness and effect in increasing the width and the cost of buildings. Window ventilation by itself can provide any degree of ventilation required if it is used intelligently. Too often the fear of draughts leads to the closing of windows except in really warm weather. Ventilation openings behind radiators are closed at the

beginning of winter and are forgotten afterwards, accumulating a deposit of dust and fluff in an inaccessible position. Windows are closed while a patient is stripped for examination or for blanket bathing, and the nurse forgets to open them afterwards. So long as such things are regarded as of little importance, any system will give bad results. But if we elevate good ventilation to its proper place as a therapeutic agent, a form of physical medicine which is a valuable adjuvant in the treatment of the sick, and train medical students and nurses in its principles and application, then even the provision now made by architects will be found generally satisfactory.

The practice of heating the incoming air is, I am glad to say, becoming less favoured. In view of the teachings of physiology, it seems to me to be wrong in principle, unless it is limited to taking the chill off very cold air.

With regard to the form of window, sash windows are still being used more than casements in large wards. The double hung sash, made of good materials and hung on chains, is easy to manipulate and to clean. It does nothing to break strong currents, and of course allows only half the window space to be open. Casements allow practically the whole space to be opened, but may not be regarded as suitable in mental or children's hospitals in view of the risk that patients may fall out. Casements ought to open outward, even if they are more difficult to clean, because they can be adjusted very well to regulate the entering current of air, and because it is easier to make them raintight. Variations in the direction of the wind can be met by opening one or other half in varying degree, so as to interpose a baffle or barrier against too strong a current. Particularly to be welcomed are the newer designs of casement window, vertically pivoted about a third of the distance from its edge. Such a window, combined with friction joints and a fastening on the principle of the inclined plane, gives a degree of comfort to window ventilation not previously attained. Their use demands less intelligence and less constant attention than does ventilation by sash windows, while the noise of rattling stays and the danger of breakage in a high wind are practically eliminated.

The ward window, whether of the sash or of the casement type, is best completed above by a hopper, hinged below and opening inward to a considerable angle. Side cheeks of glass are a necessary evil, in order that the cold entering air may not fall directly down on the patient, but may be directed upward and distributed from the ceiling. Some windows are now made with a similar, but considerably smaller, hopper along the lower part of the window, which serves something of the same purpose as the Hinckes-Bird device for sash windows. It is generally agreed that ward windows should be low enough to allow bed patients to see out, that is, within 33 in. or at most 36 in. of floor level, and should extend within a foot of the ceiling for the sake of good lighting and ventilation from the ceiling. If, however, they extend too near the ceiling, the latter tends to become stained with the rain, and the amount of glare from the sky is apt to trouble patients facing the window. If it is thought necessary to provide wall ventilators, I should prefer these to be near the ceiling, sloping upward and inward, and with an impermeable lining. The inner grating should be detachable for periodical cleaning, and there should be no means of closing it.

Another type of window which has been commended by the Scottish Board of Health, but of which I have no personal experience, is the Austral window, the two sashes of which are horizontally pivoted so as to direct the entering air upward and to keep out rain.

Hitherto we have had chiefly in mind the conventional large ward of twenty or thirty or more beds with its long axis north and south. In general hospitals the tendency towards smaller wards, already mentioned, has got little further than the provision of side wards of from one to four beds. In fever hospitals also, the growing demand for isolation accommodation has led to the provision of more small wards. Although large wards allow better supervision of patients and a slight economy of

service, they are inferior to a system of small wards, in several respects. The latter allow much better classification of patients according to their disease and the requirements of treatment, their age and social or educational position, and so contribute greatly to their comfort and happiness. They become more useful the more patients are expected to contribute to the cost of their maintenance according to their means. It might be thought that the ventilation of large wards would be easier by means of opposed windows, but my experience is that the ventilation of small wards gives less trouble and more comfort, and that individual needs can be better dealt with in the way of providing extra warmth and freedom from draughts in cases where such is required. Small wards, each of four beds, solve many problems of ventilation and lighting where the beds can be placed parallel to the window. It is easier to approach the ideal of one side being completely open while the opposite wall, generally opening into a corridor, can have as much or as little glass as is desired for supervision, and one or several fanlights for cross-ventilation on still days. The bogy of dead or unventilated spaces can easily be overcome by proper use of the windows and fanlights. The newer architecture allows much more window space relatively to solid wall. A report to the Royal Institute of British Architects[1] on the orientation of buildings contains the following statements: "Whilst public opinion is demanding the most ample admission of light, air and sunshine to the interiors of domestic, factory and office buildings, hospital wards are still being planned with over 60% of the external wall space taken up by solid brickwork. . . . Wards are now being erected in this country where the actual amount of solid wall now occupies only 34% of the wall surface instead of 70% as in the older type of wards. The Committee are informed that the additional cost of maintaining the necessary minimum temperature in view of the larger window area has been carefully investigated, and is considered to be immaterial." These are the views of a strong committee of experts.

If balconies are desired they should be quite narrow, say from 3 ft. to 5 ft. Wide balconies and roofs of verandahs undoubtedly cut off an undue amount of light and ventilation from rooms below.

Objection may be taken to small wards on the ground of increased capital cost, but it must be taken into account that the segregating effect of partition walls and the higher standard of ventilation which it is suggested can be attained make possible a greater density of beds. Even allowing for a central corridor of 8 ft., the floor space per patient need be no more than 100 sq. ft., and indeed may be as low as 86 sq. ft. without harm in general hospitals. Within limits, floor space may be reduced in proportion as the ventilation is increased.

So-called "verandah-wards" have been recently designed which are claimed to combine the advantages without the disadvantages of the ward with a verandah. The Dosquet ward described in the German literature is such a ward. In England another is described in the Report to the Royal Institute of British Architects already referred to, which is only 20 ft. wide, and has the side walls mainly of folding glass doors, allowing complete access of sunshine and air from both sides if desired. It is divided by partitions, mainly of glass, into cubicles, each with four beds, parallel to the outside windows, and allowing ample corridor space along one side of the ward.

Heating.—The heating and ventilation of hospital wards are so interdependent that they cannot be discussed apart, and several points in regard to heating have already been referred to. German writers have certainly gone very fully into the engineering details, but it is difficult to accept the dictum of Schmieden that the problem of heating is now solved, but not that of ventilation. We would all agree, I believe, with the conclusion of the New York State Commission on Ventilation that overheating constitutes the chief ill-effect of air upon health. Overheating of rooms has long been recognized as one of the chief causes of respiratory catarrh. The best

[1] *Journ. R.I.B.A.*, Sept. 10, 1932, p. 777.

source of heat is a person's own body, and the only problem that ought to arise is that of regulating its loss or conservation by ventilation and clothing. But a hospital patient is not in the position of a healthy person, who can by muscular exertion multiply the heat-production of his basal metabolism by ten to fifteen times, or even in the position of the child in an open-air school who alternates periods of lessons and physical exercise. For him some supplementary heat is necessary in winter, although not to the extent that is commonly believed necessary.

Heating of the air to be breathed is founded on a wrong principle, and is, in addition, uneconomical. From personal experience we know that if the feet, the hands and the ears are kept warm, the rest of the body will look after itself. Recognizing the importance of keeping the feet warm, certain schools and churches warm the floor to a temperature of from 70° to 75° F. Three sanatoria, to my knowledge, supply warmth to their ambulant patients in dining rooms in the same way. In the King George V Sanatorium a hot-water pipe just above floor-level under each dining table gives entire satisfaction. For patients in bed, electrically heated mattresses were formerly used by Sir Henry Gauvain at Alton, but in general hospitals and in most private houses a sufficiency of blankets, along with bed socks, achieves the same end. It is the patient's head and upper extremities that require some extra heat in winter. If a mild beam of radiant heat could be focused on those parts the problem would be solved. Panel heating by hot-water pipes embedded in the ceiling or in the walls is said by Vernon to confer the same degree of comfort with a room temperature of 55° F. as heating by convection to 65° F. Radiant heat has little effect in heating the air through which it passes, and is therefore claimed to be the more economical. The technical difficulties of heating hospital wards by radiant heat have not yet been satisfactorily solved, and the older methods of heating have still to be relied on.

Under ordinary circumstances an open fire in a large ward is something of a luxury. Its ventilating action should be unnecessary with cross-window ventilation even moderately well managed. A fire is a necessity if there is no day-room for convalescent patients, and it provides for those sitting around it a comfortable source of radiant heat. Otherwise, unless it is arranged to deliver a flow of heated air in the ward, it does little more than pretend to heat the ward. Even this and its admitted cheerfulness may justify its use in a large ward freely ventilated in the way I have suggested. Where fires are used in wards they are best placed at either end.

The objections to steam heating of wards are many—the musty, stale smell, as unappetizing as the conditioned air of the tube railways, and the complication of guards to prevent burns being the chief. High-pressure hot water has very similar defects. Almost universally employed now is heating by low-pressure hot water, usually circulated by pump from a central boiler house. A radiator under each ward window is the usual mode of distributing the heat. For my part I prefer pipe heating, as being cleaner and ensuring more even distribution of the heat. As it passes under a window and under the bed head the pipe gives off enough heat to bear up and allow to be sufficiently mixed the cold air entering at the top of the window. A radiator is likely to cause a rising current strong enough to divert the cold air down on the bald head of an adjoining patient. A new form of radiator with a flat surface, spread over a larger area and applied closely to the wall, is really a form of panel heating, which offers hope of avoiding the objections of the other systems. In theory, radiators in the centre of a ward should give off more radiant heat and be preferable to wall radiators, but in practice this is not so, and two hospitals of which I know have recently decided to go back to wall radiators.

Lighting.—On this subject I am not aware that there is much controversy except on details. With regard to daylight, the ideal to be aimed at is the maximum of diffuse light without glare. The orientation and surroundings of the hospital are

relevant factors. In most cases hospital wards face east and west, since a south aspect generally makes the ward uncomfortably hot in summer, and allows less of the floor and walls to be swept by direct sunlight than where the ward faces east and west. For the same reason the administration blocks should be at the north end of the wards. It is better to use the south end of the ward as a sun-balcony or day-room, instead of placing the sanitary accommodation there.

Sanatorium wards generally face south, or a little east or west of south, which may be of some advantage in winter, and is not of much disadvantage in summer because of the copious ventilation which is possible. Convalescent wards in sanatoria may well face east and west.

Glare from the sky is often troublesome, especially in infectious diseases with complications of the eye. The discomforts of glare and of reading in face of a bright source of light may be unsuspected causes of fatigue and headache. The really sick patients are most likely to suffer, since many of them, particularly the surgical cases, are compelled to lie or recline on their back. Naturally glare is less troublesome where the ward faces other buildings or a screen of trees. The higher the windows go to the ceiling, the greater the discomfort from glare. On upper floors especially, it may be an advantage to place the beds parallel to the windows, a practice that is commoner abroad than in England. Discomfort from glare is almost entirely avoided in the small wards which I commended earlier.

The question of blinds and curtains deserves mention. Wherever possible, these should be dispensed with, for the sake of good ventilation and cleanliness, as is the practice in most sanatoria. Patients generally accustom themselves quickly to sleeping in the evening and morning daylight in summer, but it is recognized that very sick patients may be fretted by too much light and may suffer from the absence of blinds at a critical stage in their illness, for example, before operation. For them again selective treatment in small wards would solve the difficulty. The necessities of nursing in wards overlooked by other buildings may make blinds or curtains inevitable. Each case must be considered according to its circumstances.

The colour of walls in hospital wards has a good deal to do with the efficiency of the lighting. It is now generally reckoned an advantage to use colours which will show dirt rather than hide it. Very light colours, such as pale green or cream, combine a pleasing effect with nearly the maximum reflection of light. Ceilings should be lighter still, generally a " broken " white.

The supply of artificial light should not be niggardly. General ward lighting, by reflection from the ceiling, can be made quite satisfactory when carefully arranged, but generally wall lighting is preferred. Electric light should be supplied over each bed by a wall bracket and a shaded lamp, with the switch accessible to the patient. Such a light at a height of approximately 6 ft. from the floor, and of not less power than 25 watts, will provide for comfortable reading by the patient, and for nursing attention and treatment by the staff, without glare affecting other patients. In two hospitals known to me, these bracket lights have their broad base detachable from a flat hook on the wall, thus providing all the advantages of a movable side-light for examining throats or eyes or skin rashes. They have, however, the disadvantages of dangling flexes, collecting dust, and it is more usual to prefer a fixed wall light over each bed and, between each pair of beds, a point into which to plug a side-light. Dr. Gordon Pugh, of Queen Mary's Hospital, Carshalton, recommends a less expensive alternative, by which the interval between windows is wide enough to take two beds. One wall bracket light with a spherical white glass shade is shared between the two beds. The light is thus oblique, and does not cause glare to a recumbent patient.

With a system of lights over bed heads, very few central lights are needed for general illumination in large wards, perhaps one over a sterilizer table or drug cupboard and one over a fireplace for the use of ambulant patients. A shaded light must be provided over the nurse's table and one or two ceiling lights with inverted

shades as night lights. The switches for the latter should be separated from the other switches to prevent bright lights being switched on in mistake at night. Another minor improvement is the effort now being made to provide noiseless switches.

Having regard to the times, I have in this paper avoided referring to methods of ventilating, heating and lighting hospitals, which, although possibly better than those now in use, involve very heavy expenditure. When electricity can be supplied sufficiently cheaply for heating wards and for regulating ventilation, the time may come when it will have as complete a monopoly in those services as it now has in regard to illumination.

Discussion.—Dr. ALEXANDER JOE said that he was a whole-hearted believer in the value of fresh air in the treatment of the acute infectious diseases, and workers in this field owed much to the tuberculosis experts for ideas as to the ways and means of providing it. He had found fresh air particularly of benefit in the treatment of infections of the respiratory and upper air tracts, and generally it induced rest and sleep and promoted appetite. It had an undoubtedly beneficial effect on inflamed mucosa and on that account probably did something to lessen the period of infectivity, whilst the dilution of infection in well-ventilated wards was one of the most important methods of minimizing "droplet" cross-infection. He considered that for the treatment of such diseases as the septic type of scarlet fever, whooping-cough and measles with their associated bronchopneumonia, open-air treatment was essential, and that in the present epidemiological type of scarlet fever, probably the only contra-indication to open-air treatment was when nephritis had developed. As to the methods of carrying out the treatment, he was convinced that open-air with adequate safeguards against strong sun or bitter wind was superior to a roofed balcony, and a roofed balcony to the open-sided ward. He agreed with Dr. Watt that in a ward abundant ventilation was of more importance than the maintenance of a uniform level of temperature, and in his own practice he did not worry unduly about a low ward temperature, but insisted on the body-warmth of individual patients being maintained in bed by hot bottles, adequate personal and bed clothes. The latter method, whilst imposing a strain on the nursing staff, *could* be carried out, and in his hospital patients who had whooping-cough and measles were put out in their cots on the ward balconies for part of the day all the year round, except on days when the wind was bitterly cold.

Mr. H. W. BINNS showed some photographs of a hospital for totally disabled soldiers and sailors (St. David's Home, Ealing) of which he was the architect. He explained that this home was built to accommodate the worst type of the incurable illnesses brought about by war service, such as encephalitis lethargica, rheumatoid arthritis, etc. Practically all the patients were incontinent and from thirty to fifty per cent. entirely bedridden, and it naturally followed that they were inmates for a considerable period.

Fig. 1 (p. 88) was a view taken inside the "cloister" which formed one end of a four-sided "garden courtyard" around which the new wing had been built. The two-storey building on the opposite side of the courtyard had male nurses' accommodation on the upper floor. This photograph also showed one of the small wards with a certain amount of extra cross ventilation at either end. Mr. Binns drew attention to the domestic treatment of the cloisters such as the limed oak beams in the ceiling, the design of the lamps and the treatment of the tile floor, etc., all of which, although they did not affect the efficiency of the building, helped to give it an "atmosphere" different from that generally associated with a building of this kind.

Fig. 2 showed the cloisters occupied by beds, as seen from the garden. The windows on the back wall were sliding and glazed with "vita-glass" so that in very hot weather the patients had all the benefit of being out of doors without the discomfort from the sun and with controlled protection against draughts.

Fig. 3 showed the interior of one of the larger wards and attention was drawn to the two-faced fireplace which had its chimney passing under the floor. Attention was also called to the windows with pivot-hung casements to the lower parts, and hoppers falling inward above the transomes were also shown on this photograph. The colour scheme comprised a brown oak wood block floor, saxe-blue dado and light primrose buff walls and ceilings. The windows were kept low to enable patients in bed to see the gardens, etc.

FIG. 1.

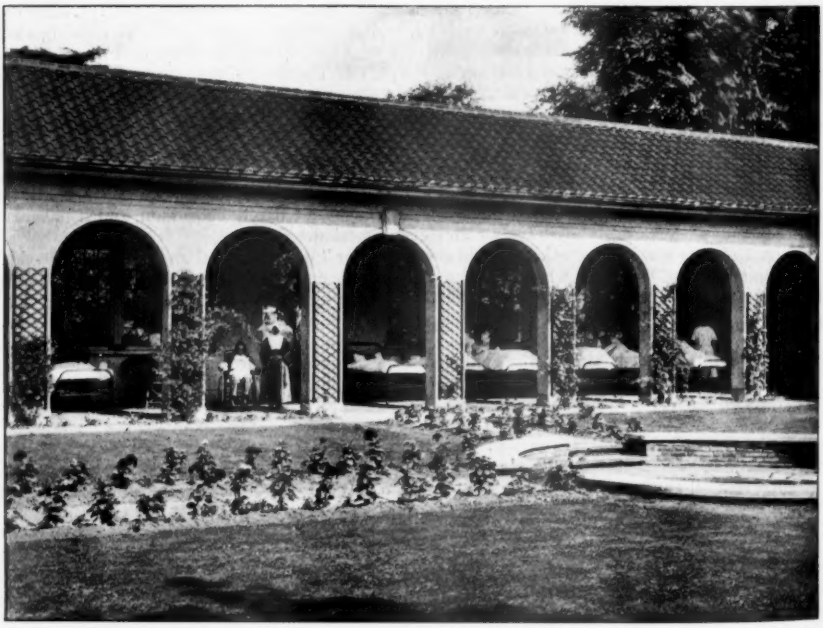


FIG. 2.

FIG. 3.

FIG. 4.

In a hospital of this kind with plenty of land available, and in which a one-storey building was an advantage, a cloister was better than a verandah as it did not take away light from the wards and enabled the patients to have complete change of scene and environment and also to interview their families in a garden instead of in a ward, with the advantage of a further degree of privacy.

Mr. Binns then showed some photographs of St. Vincent's Orthopædic Hospital at Eastcote, of which he was appointed the Architect some four years ago.

Fig. 4 showed one of the new wards with similar accommodation to that in the old type of ward, but designed to be more cheerful, lighter, and better controlled in regard to ventilation.

FIG. 5.

Fig. 5 showed the new babies' ward which had just been completed, with its broad teak platform on the south-east side where the three rows of beds which the interior of the ward accommodated could be pushed out. It did not, however, clearly show the side windows which had sliding control, or the sliding glazed screen which could shut off two-thirds of the ward in very bad weather.

Mr. L. G. PEARSON said that Dr. Watt's paper was a valuable contribution to a subject which was the crux of hospital planning. The ventilation and heating of the ward decided the plan to a large extent, and in emphasizing the importance of cross-ventilation Dr. Watt was a refreshing contrast to some members of his profession.

Dr. Watt's suggestion that the small ward, particularly the four-bed ward, with a large window on one side and fanlights to a ventilated corridor was the solution of the difficulty of supplying fresh air without draughts, seemed to point the way for the future of hospital planning. It would radically affect the lay-out of the plan, and would enable the beds to be placed parallel with the external wall, much to the benefit of the patient. The difficulty would be to satisfy the nursing staff, who preferred the large open ward with right-angle

beds, on account of supervision. But it was to be hoped that the "parallel bed" ward would be adopted widely in this country as it already had been on the Continent.

With regard to heating, low-pressure hot-water radiators under the windows still appeared to be the most suitable for wards, though panel heating and other forms, such as floor heating, had their uses. However, changes were to be expected when the cost of electricity went down, in fact one might hope to see the radiator freed from the supply pipe, and it might be possible to place it in all sorts of positions—for instance, attached to the foot of the bed.

Electro-vapour radiators had already been installed in a hospital in the West of England, and this type seemed to have great possibilities. At the same time it was to be hoped that there might still be a use for the open fireplace where cheerfulness and additional warmth were required.

Fleet-Surgeon W. E. HOME said that in a hospital ship between Havre and Southampton during the late war, the patients in the large saloon slept badly as a rule, until it was found that the large fans were out of order, and when these were put right, the patients in the now well-ventilated ward, slept vastly better.

Mr. T. B. LAYTON said he feared that he and his fellow clinicians paid lip-service to ventilation, light and heat, but did little to help in the application of these principles.

Much of his own work was concerned with the problem of how to prevent the patient recovering from acute streptococcal disease from passing into a stage of chronic illness. He was convinced that the best treatment for this stage of streptococcal disease was the same as the treatment for tuberculosis. He found himself in agreement with most of what Dr. Watt had said, and especially with the opinion that in the treatment by fresh air and sunlight, the latter was the less important factor, the passage of cool air over the surfaces of the body the more important. He believed that there was still too great a fear of cold, especially in the development of nephritis. He wished specially to note two of Dr. Watt's points, namely, the psychological effects of these things, and the fallibility of the human factor in management, but he was disappointed that Dr. Watt had spoken with such a luke-warm feeling for balconies and verandahs. His own feeling was that adequate balcony accommodation should be an integral part of every ward to-day.

With regard to the "fallibility of the human factor," there was too great a tendency on the part of the medical profession to leave the airing of the wards to the nursing staff so that their patients might become subjected to the whim of a Sister. He knew of a ward which at times stank like a fried fish shop, and another the windows of which were so widely opened that the December gales blew through them, so that all those within them who were not in bed were pinched with cold. The question of keeping the wards at a lower temperature than had been the custom became a difficulty when some of the patients were up, as though it was easy to keep patients warm when they were in bed, it was less easy to do so when they were about.

Lastly he would ask whether orange had been tried as a colour for the walls.

Dr. T. S. MCINTOSH said he had been pleased to hear Dr. Watt say that exposure to the direct rays of the sun, without the accompaniment of currents of air, might be far from pleasant for the patient. Exposure to sun right out in the open was one thing, but it was quite another if the patient was lying in a ward or even on a verandah. To lie in a ward with the sun pouring in on one through the window could be very trying. Even verandahs which acted as sun-traps might be very uncomfortable, and a verandah with a southern aspect and a glass roof could be quite intolerable. In such circumstances one usually found that the glass roof had been painted green to exclude the sun's rays.

The temperature of wards was usually too high, and the uniformity of temperature produced by central heating was bad. Unfortunately, nowadays, everything was planned to save trouble and it was less trouble to keep a constant dead level of temperature than to vary patient's clothing with varying temperatures. It was not so good for the patients, however. Apart from certain special forms of illness which might call for uniformity of temperature, patients, like healthy people, were the better for variations which called for a response from the heat-regulating mechanisms of their bodies.

He, Dr. McIntosh, agreed as to the desirability of small wards, but they caused difficulties in planning unless one was content with direct openings into the open air on one side only. One side of the small wards was bound to open into a corridor. In the case of single-storey pavilions, by making the corridor lower than the wards, there could be windows opening over the corridor, but in multiple-storey buildings this, of course, was not possible.

Dr. E. W. GOODALL said that changes in hospital design had been going on for a long period, but they were not always for the best. Some of the hospitals built a century or so ago were anything but an improvement on those erected at an earlier date. For instance, the surgical wards at Guy's Hospital, which were part of the original building, were much better as regards light and ventilation than those in the large block—the medical wards—which were built later. With regard to the height of the windows above the floor: in the days when typhus and typhoid fever were very prevalent, the windows were placed high so that delirious patients should not get out of them. Doubtless, bars could be placed across windows that came nearer the floor, but they gave a prison-like appearance to the wards. He was surprised that Mr. Pearson anticipated opposition to the arrangement of small wards of from one to four beds each; he would not meet with objections from medical men, at any rate from those who had to do with fever hospitals. But, of course, there was the question of cost—both of erection and of maintenance—to be considered. As to the question of the exposure of patients more or less in the open-air, the public required education; ignorant people still had rooted objections to open windows.

Section of Obstetrics and Gynæcology.

President—J. P. HEDLEY, M.Ch.

[*May* 19, 1933.]

Struma Ovarii.

By C. D. LOCHRANE, M.D.

THE sections shown were taken from a broadly pedunculated, multiloculated cystic tumour of the right ovary, of about the size of an ostrich's egg, and rising out of the pelvis to the level of 2 to 3 fingerbreadths above the umbilicus. The patient from whom the tumour was removed in June, 1929, was an otherwise apparently healthy nulligravida, aged 43 years. She had been married for four years. Menstruation had become irregular and rather scanty since about the time of marriage. There was no inter-menstrual loss of any kind.

The ovariotomy was quite uncomplicated. There were no adhesions and no suggestion of recent or former torsion of the pedicle. Ascites was absent.

The tumour was roughly ovoid in shape, with a smooth fibrous wall. On gross section it had the general characteristics of a multilocular ovarian cyst of pseudomucinous type, and consisted of numerous loculi of varying size containing a colloid or mucinous-looking fluid. No area having the appearance of a definite "dermoid process" was demonstrable, and no hair, cartilage, bone, teeth, fat, etc., were present. The tissue from which the sections were taken was the only notably solid area of any size throughout the tumour. It was of relatively small dimensions and was situated in the outer wall of the tumour, near the insertion of its pedicle. Microscopic sections from this tissue show massive necrosis and free hæmorrhage. The recognizable parts consist of gland-like spaces lined by a low columnar or spheroidal epithelium, the cells of which in certain areas show aberrant mitotic figures in their nuclei and a tendency to mucoid degeneration.

The stroma is myxomatous and apparently consists of connective tissue of embryonic type.

The appearances are those of embryonic thyroid tissue. The irregular mitoses in parts of the tumour and extensive area of necrosis strongly suggest malignancy.

Sections did not stain brightly even in the best areas, and these two negatives therefore rather lack "body," but they show the difference fairly well—irregular mitoses and invasion. It is, of course, questionable whether these invasive appearances are to be regarded as abnormal in view of the tendency for epithelial cell groups to occur in the interglandular stroma in normal thyroid tissue.[1] The appearances in one of the sections is strikingly suggestive, however, of an abnormal epithelial invasion of the stroma.

Sections taken from a different part of the tumour showed a portion of cyst wall having a fibrous stroma lined with a low or flattened columnar epithelium, not typical of the lining epithelium peculiar to cysts of pseudomucinous type.

The features of interest in this tumour are the occurrence of an area of thyroid tissue of embryonic type in the wall of a non-papilliferous polycystic ovarian tumour

[1] Mrs. F. D. Thompson: "The thyroid and parathyroid glands throughout vertebrates, with observations on some other closely related structures." *Phil. Trans.*, 1910, Lond. 1911, s. B. cci, 91-132.

with colloid-like contents, the absence of other elements of teratomatous type, such as squamous epithelium, sebaceous glands, hair, fat, cartilage, etc., and the presence of invasive appearances in certain areas of the thyroid tissue.

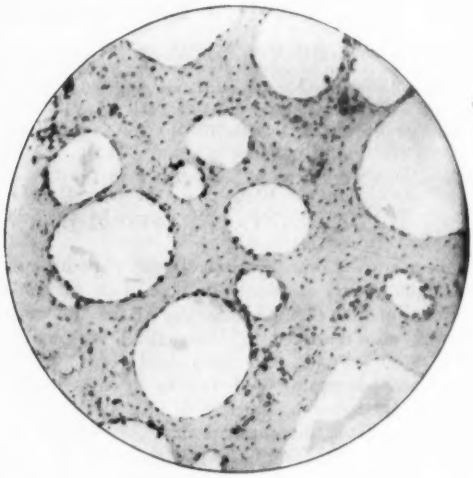


FIG. 1.

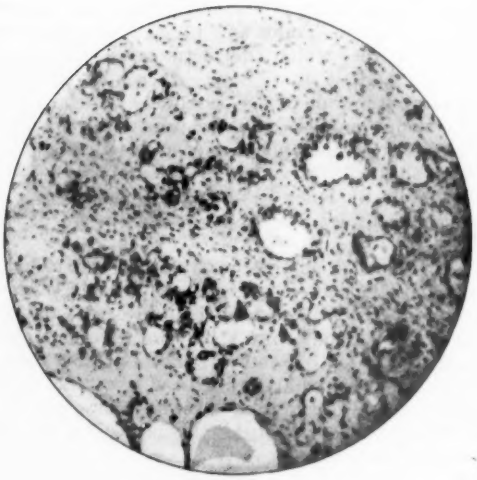


FIG. 2.

It is regrettable that a further investigation of the histological features and of the chemical nature of the contents of the cystic portions of the whole tumour was prevented by the inadvertent destruction of the specimen by a too industrious laboratory attendant. It is impossible to say, therefore, whether the whole specimen

was to be regarded as a pseudomucinous ovarian cystadenoma with a teratomatous area in its wall, or a cystic teratoma in which the thyroid element had outgrown or crowded out all other teratomatous elements.

It is to be noted that the gross tumour showed no macroscopic appearance of necrosis or interference with its blood supply, and no evidence that there had been torsion of the pedicle of any degree whatever, such as might account for the necrotic appearances in the thyroid tissue.

Rhabdomyosarcoma of the Corpus Uteri.

By C. D. Lochrane, M.D.

Mrs. S. G., aged 56.

Clinical history.—Admitted to the Derbyshire Hospital for Women, 2.3.32, in an exsanguinated condition, with a history of severe hæmorrhage from the vagina for two weeks and slight occasional "spotting" for a few weeks previously. The menopause had been complete for three years previously. Patient gave no history of menorrhagia or epimenorrhœa before final cessation of the menstrual function. There had been no previous loss of weight *and no failure of strength or general well-being until after the onset of the severe bleedings.*

Obstetric history.—3-para. Youngest child aged 16 years. All labours natural apparently; no abortions; puerperia non-febrile.

Bimanual examination.—An ovoid slightly nodulated mass of moderately firm consistence, and slightly friable, protruded from the greatly dilated cervical canal. The mass felt to be about the size of a tennis ball and appeared to have a not very broad attachment to the uterine wall within the uterine cavity, though whether actually pedunculated or not it was impossible to note. The whole mass was dark red in colour and had more the appearance of old, slightly organized blood-clot than of a new growth. There was a considerable amount of dark blood in the vagina and cervical canal. Removal of the mass was not difficult, but it broke up readily on the necessary handling and had then the appearance of an encapsuled blood-clot or possibly of a new growth into which there had been very general and extensive old hæmorrhage. After removal of the mass the uterus was still found to be enlarged to about the size of a ten-weeks' pregnancy and partly retroverted. The uterine cavity was enlarged and dilated and the site of attachment of the polypoid mass formed a roughened area on the anterior wall just above the level of the internal os of about the diameter of a half-crown. The remainder of the lining of the cavity within reach of the examining finger appeared to be smooth. After removal of the mass, a curettage was done for diagnostic purposes, in view of the suspicious naked-eye appearances of the mass already removed.

Microscopic examination.—Portions of the polypoid mass examined, including sections taken from the region of its intra-uterine attachment, had the appearances of a necrotic fibroid largely suffused with blood which was undergoing early organization, but also containing numerous large very thin-walled blood sinuses. No differential staining was used in this examination. The endometrial tissue removed from the uterine cavity by curettage was œdematous and vascular, and there were a number of polypoid processes with a myxomatous stroma; the glands were large but with epithelium degenerate in appearance. At this time the appearances did not give any suggestive indication of malignancy though the extensive extravasation of blood in the tissues examined made interpretation difficult. The patient had a non-febrile convalescence and all hæmorrhage ceased in a few days. She was kept under observation, despite the above pathological report, in view of the somewhat suspicious clinical appearances at operation. There was no recurrence of blood loss until after

a vaginal examination six weeks later, when very slight bleeding occurred on the two following days. At this examination the os externum was only slightly patulous, and the uterus not larger than at a six or seven weeks' pregnancy. The patient's condition showed marked improvement, though there was still some pallor. Slight hæmorrhage recurred for two days four weeks later, and she reported herself a week later again stating that there had been very little blood loss, but that she had had some mild gripy pains in the pelvis for a few days and some watery odorous vaginal discharge on the two previous days with the passage of a dozen or more small fleshy-white pieces of tissue. Examination now showed the uterus to be slightly larger than on the previous occasion and the cervical canal more dilated and patulous, admitting one finger easily. Some polypoid growths of small size could be felt within the uterine cavity. Further tissue removed with the curette from the upper portion of the cavity of the uterus on this occasion showed several small masses of tissue which, on microscopic examination, proved to be œdematous and partly necrotic tissue having the structure of a rhabdomyosarcoma. On this report a hystero-salpingo-oöphorectomy of a fairly radical type was carried out, with moderately wide removal of the parametrial tissues, the vagina being divided between clamps. There was no demonstrable infiltration of the parametrium and no palpable involvement of the iliac or lumbar lymph glands. None of these latter were removed. The uterus on removal was about the size of an eight to ten weeks pregnant organ. When it was laid open the corporeal wall was seen to be from $\frac{1}{2}$ in. to $\frac{3}{4}$ in. thick in most places. Several broadly pedunculated fatty-looking polypi of moderate size sprang from the walls of the upper part of the uterine cavity, and one polyp of similar type had its attachment slightly above the internal os uteri. The largest of these was about the size of a pigeon's egg (average).

The patient made an uninterrupted and non-febrile recovery, and, when last examined two weeks ago, she appeared to be very well indeed and had gained 17 lb. in weight in the preceding six months. Careful bimanual examination showed no trace of local recurrence, i.e., approximately eleven months after operation.

The specimen shows the organ slightly shrunken in the process of preparation for mounting. In the gross specimen no marked evidence of infiltration of the muscle wall is visible to the naked eye.

Histological report.—The histological investigation of the preliminary curettings, and of the uterine tumour following the hysterectomy, was carried out for me by Professor E. Haswell Wilson,[1] to whom I am indebted for the reports on the histological appearances seen in the various sections, and also for the photomicrographs. Sections of the curettings taken from the upper portion of the uterine cavity preliminary to the removal of the uterus, showed these to consist almost entirely of tissue having the structure of a rhabdomyosarcoma. Much of the tissue, especially towards the apices of the polypoid projections, was œdematous and parts were necrotic. Extensive interstitial hæmorrhage had occurred in places. Irregularly interlacing strands of large, greatly elongated, cells occurred in abundance in an irregular manner throughout the tissue. Some of these cells were swollen and hyaline in appearance, but many showed a faint suggestion of cross-striation on the ordinary preliminary staining by hæmatoxylin and eosin. This latter appearance was abundantly confirmed on differential staining. Parts of the growth were definitely sarcomatous, and in these cross-striation was not seen. In other places the abnormal type of cell appeared to merge into smooth muscle. Only traces of endometrium were visible on the surface of the growth, the tumour appearing to have ulcerated through it extensively into the lumen of the uterine cavity. There was no suggestion of encapsulation in any portion of the tumour on either gross or microscopic examination. No traces of epithelial structures (apart from the few endometrial

[1] Of the Department of Pathology, University of Birmingham.

FIG. 1.—Uterus with polypoid tumours attached to fundus.

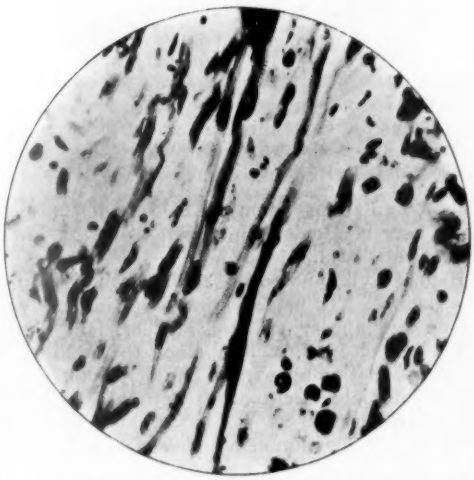


FIG. 2.—Section IV. (× 250. Heidenhain's iron hæmatoxylin).

glands and surface remnants of endometrial epithelium) or of bony, cartilaginous, or other suggestively teratomatous elements were present in any of the several sections examined.

The first two sections illustrate the appearances seen in the tissue removed at the preliminary curettage. This material was rapidly fixed and cut, and the pictures are not therefore so clean cut as are the final three sections which are taken from the uterine wall after removal and put through more slowly. Owing to the exigencies of time and space none of these preparations was cut less than twenty-four hours after collection of the tissue to be sectioned, but this has not affected the striking appearances of striated muscle and other less differentiated cells of embryonic type so relatively abundant in the sections.

Section I. (Curettings—hæmatoxylin and eosin) × 250, shows broad, ill-defined bands of muscle-fibre with blunt-ended nuclei. The appearances here gave the suggestion of the diagnosis and indicated the need for the differential staining, but striation can be made out faintly in some fibres even here.

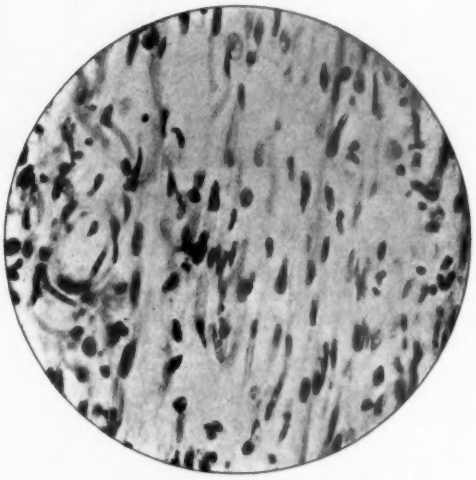


FIG. 3.—Section V. (× 50, H. and E.).

Section II (× 250) is an almost identical field from the curettage tissue. The differential stain used here is Heidenhain's iron hæmatoxylin. This gives a very dense picture but striation is readily seen.

Section III. (Hæmatoxylin and eosin) × 250, is of tissue from the solid part of the tumour near the fundus. The muscle-fibres occur in closely approximated groups throughout the tissue and appear as long, slender, faintly staining, often wavy, ribbons with large nuclei, rich in chromatin, elongated in shape but with blunt ends. In most places the cross-striation appears to be fairly complete, but here and there a cell of a less fully differentiated and more embryonal type is visible.

Section IV. (The same section as III but stained with Heidenhain's iron and hæmatoxylin) × 250. This shows unmistakable striation in the long slender muscle-fibres.

Section V. (Hæmatoxylin and eosin) × 50, is from an œdematous part of the growth nearer to the cervix. This gives a general low-power view of the

muscle-fibres spaced by what may be ordinary œdema or a ground substance of ill-defined sort. Some of the fibres are cut transversely, others in the long axis. The fibres have a "fat" cylindrical or a ribbon-like appearance, according to the plane of section, which is quite unlike what is seen in an ordinary fibroid even when it is œdematous.

N.B.—This part of the tumour also showed striation when stained by Heidenhain's stain, but in this portion it was more patchy and not so suitable for demonstration.

The majority of the blood-vessels throughout the growth are rather poorly developed. Many are represented by relatively large blood-channels having a single layer of endothelial cells only, and in a few places even this is absent. The appearances of this tumour of the corpus uteri, therefore, are those of a sarcomatous new growth containing abundant very irregularly arranged groups of large and much elongated cells showing cross-striation. In most instances these cells have fairly well differentiated appearances, but in places they are suggestively embryonal in type. The striated muscle appears to be the only heterotopic type of tissue present. The absence of cartilaginous or bony tissue, or of any heterotopic tissues of "lepidic" type, appears to justify the view that the growth is not a teratoma in the accepted sense of the term. The various elements of which it is composed suggest the title of "rhabdomyosarcoma" as most appropriate for this growth. It may properly be included in the broad category of "mixed tumours" of the uterus and vagina so comprehensively and eruditely discussed by Wilfrid Shaw (*Journ. of Obstet. and Gyn. of Brit. Emp.*, 1928, xxxv, pp. 498 *et seq.*).

The common feature of these so-called "mixed tumours" is a stroma largely of sarcomatous type but containing other cell elements of a type normally alien to the organ in which the growth is found. Shaw has classed in this broad group:—

(1) Botryoid or grape-like sarcomata of the cervix uteri, (2) tumours of the corpus uteri of the general type here shown, but containing in different instances heterotopic tissue elements of very varying histological character, and (3) certain sarcomatous tumours of the vagina, occurring in young children.

These are all more or less closely related to certain other tumours of the type described by Wilms[1] in the kidney and by others in the prostate, other parts of the urinary tract and elsewhere.

An investigation of the recorded literature on the subject of these vaginal, cervical and corporeal mixed tumours indicates the corpus uteri to be definitely the least common site of their occurrence. Shaw[2] was able to collect only thirteen recorded cases of corporeal "mixed tumours," of whatever variety, up to 1928. In more than half of the instances the alien tissue element was cartilage, bone, fat cells, smooth muscle, nerve-cells or embryonic ground tissue. The presence of striated muscle-fibres was recorded in only six of these thirteen cases however. A further case of this latter type was recorded by Shapiro[3] in 1931, making, with the present instance, eight recorded cases in all. The condition is thus of rare occurrence, though in all probability it is less so than these figures appear to indicate. The striated muscle cells are easily missed in the absence of differential staining. This nearly occurred even in the present case in which the striated fibres appear to be relatively more abundant, and the individual fibres better differentiated than appears to have been the case in some at least of previously recorded cases. An early tendency to degeneration and necrosis, which appears to be a somewhat common occurrence in the less deeply situated parts of the growth, may undoubtedly obscure the picture further and increase the chances of failure to detect the true state of

1 Wilms: (Monograph) "Mischgeschwulste," Leipsic, 1900.
2 *Journ. Obstet. and Gyn. Brit. Emp.*, 1928, xxxv, 498.
3 *Amer. Journ. Obstet. and Gyn.*, 1931, xxi, 83.

affairs with ordinary staining methods. The appearance of groups of cells of markedly abnormal length, or of abnormal girth on transverse section, in the midst of areas of tissue of a sarcomatous type, should put one on the alert and indicate the need for further differential staining by the methods of Heidenhain, Giemsa, or Mallory.

The occurrence, in an organ developed from mesenchyme, of a neoplasm having as its distinctive element a tissue of mesothelial origin, is a feature of particular interest in these striated muscle-celled growths. In this respect (in the absence of proof that the phenomenon can be attributed to cell metaplasia) they form a distinctive sub-group among the mixed tumours of the corpus uteri from a teleological point of view. With one exception the heterotopic elements in all other recorded "corporeal tumours of mixed type" consisted of tissues having a common mesenchymal origin with the uterine tissue in which they occurred.

Clinically the general features of this case conformed very closely to those of the seven other cases of rhabdomyosarcoma of the body of the uterus reported in the literature. The tumour occurred in a parous subject already well past the climacteric. The first discovered tumour was polypoid, and the later discovered formations within the uterine cavity showed the same tendencies. Marked vascularity and necrotic changes were also a feature.

It is of interest to record that the patient has now survived the removal of the uterus for approximately eleven months without any demonstrable clinical evidence of local recurrence or metastases, despite the bad prognosis usually associated with these tumours, the quite extensive involvement of the uterus in this case, and the malignant histological appearances of the tumour.

I need not discuss the various theories which have been advanced to attempt to afford an explanation of how it may happen that such heterologous tissue as striated muscle may occur in the uterus in such a case as this, beyond saying that the abnormal cell elements here are obviously of embryonic type and are not to be explained on any theory of metaplastic or degenerative cell changes. Moreover, metaplasia of involuntary into voluntary muscle cells has never been proved to occur. Wilms' hypothesis of embryonic cell displacement appears unacceptable, for similar lack of proof. Nor are there other theories more capable of proof in the present state of our knowledge.

Discussion.—Dr. D. H. MACLEOD said that he had shown two cases of struma ovarii at a meeting of this Section last year.[1] Both had occurred in dermoid cysts. One specimen showed typical thyroid tissue of a colloid type, the other showed thyroid tissue similar to that seen in a toxic adenoma. He would be interested to know first, whether the presence of iodine had been determined in Dr. Lochrane's specimen and, secondly, whether toxic symptoms had been present. In neither of his own cases had there been toxic symptoms. Iodine had been found in the colloid tumour. Toxic symptoms were rare, only one case having been recorded in the literature.

Professor BLAIR-BELL said that Dr. Lochrane was to be congratulated on two very interesting specimens.

With regard to the supposed thyroid tissue in part of a pseudomucinous cyst, he was very sceptical about its being of the nature stated. Although dermoid cysts were not infrequently associated with ordinary pseudomucinous cysts, in this case there was no evidence to suggest that the suspected tissue was teratological, nor was it metastatic in origin; and these were the only two sources that could be admitted.

He agreed with Dr. MacLeod that the demonstration of iodine was essential, although that alone was hardly sufficient to prove the presence of thyroid secretion—thyroxin should be identified, and the absence of pseudomucin noted.

Histological appearances alone were deceptive. In this case the stroma was dense, and did not seem to correspond with that of the thyroid gland. The acini certainly had the

[1] *Proceedings*, 1932, xxv, 1386 (Sect. Obstet. and Gyn. 64).

appearance of those of the thyroid gland, but the similarity of the epithelium alone was not diagnostic.

He had also been much interested in the specimen of rhabdomyosarcoma of the uterus, for he had himself shown the first specimen in this country to the Section in 1912.[1] The late Professor Ernest Glynn and he had subsequently described this and another specimen,[2] with a full pathological account of the tumour, and an analysis of the cases previously recorded abroad.

Seventeen cases, and three which were doubtful, had been traced. That was twenty years ago—so that Dr. Lochrane's statement that fourteen cases only had been recorded up to the present time was obviously incorrect.

The essential histological feature of the neoplasm seemed to be that it was a mixed-celled sarcoma. Round cells, spindle cells, giant cells and often myxomatous tissue were to be found.

The most interesting point to be noted in these specimens, in which striated muscle cells, and sometimes cartilage and bone, were seen, was the fact that whereas malignant neoplasia was a process of dedifferentiation, here differentiation occurred as well. Dr. Lochrane had spoken of the presence of involuntary muscle-fibres. He (the speaker) and Professor Glynn had regarded these as embryonic muscle cells from which the striated muscle-fibres originated. It was to be remembered that striated and plain muscle arose from a common mesodermal embryonic type; hence the appearance of the striated form was not difficult to understand. Nevertheless, it was of intense interest to realize that sarcomata, in which differentiation into forms of tissue foreign to the organ in which the neoplasm occurred along with dedifferentiation, were extremely malignant.

Postscript (Dr. LOCHRANE).—With reference to Professor Blair-Bell's criticism as to the number of cases reported to date, I have since the meeting again gone over his own records (with the literature annexed) and have pointed out that three others of his cases were doubtful (? cervical) and therefore could not be included. I think, therefore, that the figures given in my article are correct.

A Review of 658 Ovariotomies.

By HERBERT R. SPENCER, M.D.

THE term "ovariotomy" in this communication means the removal of an ovarian or parovarian tumour, including the excision of a tumour from the ovary, with the retention of the rest of the organ: it does not include the removal of normal or small cystic ovaries, and the lower limit of the size of a "tumour" is that of a hen's egg. I hold the opinion that complete records of cases of operation are of much greater value than selected series, and that records made by the actual operator may be more valuable than those made by extraneous writers who have no personal knowledge of the cases. Nearly forty years ago—in December 1893—I read a paper on my first fifty ovariotomies, giving details of each case and of the other abdominal sections which I had performed up to that date [1]. I would have liked to publish similarly the rest of my cases, did time and space allow. The present review could not have been made in the time at my disposal had I not made a record, in a large note-book ruled for analysis, of the main features of each case immediately after the operation and recovery or death. I strongly advise young gynæcologists to have such a note-book as a ready means of keeping in touch with their operative work.

Ovariotomy is looked on by some as a simple and easy operation: it is in fact a more dangerous and difficult operation than hysterectomy for myoma, mainly because of the adhesions and complications which often accompany it and because of the frequent malignancy of the tumour.

1 *Proceedings*, 1911-1912, v, (Sect. Obstet. and Gyn. 164).
2 *Journ. Obstet. and Gyn., Brit. Emp.*, 1914, xxv, 5.

All the cases have been operated on by myself, and no patient who recovered has been discharged from the hospital or nursing home before the twenty-fourth day after operation.

Statistics rarely state how long the patients remain under observation after operation; patients early discharged may be recorded as "recovered" although some may have succumbed to sequelæ, such as embolism or intestinal obstruction, in the third or fourth week.

All the tumours have been examined, macroscopically and microscopically, by myself, mostly in association with my friend T. W. P. Lawrence, a few also with my lamented friend, the late Professor Shattock.

I have not divided the cystic tumours into unilocular and multilocular, or into pseudomucinous and serous, but have considered separately the tumours containing papilloma, which gives them their chief clinical importance.

Although many of the tumours were very large, none of them reached the gigantic size of those reported to have weighed 200 and even 300 pounds. One parovarian cyst contained 3 gallons of fluid—a mere pigmy in comparison with Targett's, which held 9 gallons. One ovarian fibroma (cystic) weighed 45 pounds.

The ovariotomies were bilateral in 164 cases, on the right side in 250, on the left side in 238; in six cases the side is not given. In some of the unilateral cases the other ovary had been or was subsequently removed for a similar or different growth (in one instance after twenty-five years, v. *postea*). In one case, fifteen years after the bilateral ovariotomy, an inoperable cancer of the cervix was found.

Association with Pregnancy.

Sixty-three of the tumours—nearly one-tenth—complicated pregnancy, labour or the puerperium, and twenty-three were operated on during pregnancy or labour. These sixty-three cases have been published in detail, with remarks on ovarian and parovarian cysts complicating pregnancy [2].

I would here only emphasize the inferiority of Cæsarean section to simple ovariotomy in the treatment of ovarian tumours in advanced pregnancy and labour and its superiority in the case of *parovarian* tumours in advanced pregnancy, owing to the risk of thrombosis and embolism (loc. cit., *Brit. Med. Journ.*).

The superiority of ovariotomy over Cæsarean section in the case of an ovarian cyst incarcerated in the pelvis during labour and incapable of being pushed up into the abdomen, is well illustrated by the photograph (exhibited) sent to me unsolicited by the patient in 1924, twenty-seven years after I had operated on her during labour by ovariotomy followed by forceps, while the uterus was lying on the abdominal wall (*Trans. Obst. Soc.*, Lond., 1898, xl, 14). The photograph shows the patient and her husband and nine living children (of the ten she had had since the operation).

Ages of the Patients.

Total	Age given in	Age 10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90
658 (all cases)	645	19	196	183	138	113	45	10	1
45 (parovarian)	44	2	13	19	10	0	0	0	0
66 (dermoids)	65	2	20	25	9	7	2	0	0
20 (fibroma or adenofibroma)	20	0	3	1	6	3	4	3	0
67 (malignant)	63	2	3	6	17	27	8	0	0

The youngest patient was aged 14, the eldest 82. Eleven were over 70 years of age. I have published these eleven cases [3] in detail, with some remarks on ovariotomy in the aged.

Fertility.

My records are not quite complete as to the married or single state of the patients. At least 150 of the patients were single, the youngest being 14 years old. Of the married women, at least 304 had had one or more children; eighteen of them had ten or more, and one had had 18 children. The mother of this large family, who had also had a miscarriage, was operated on for an enormous ovarian multilocular cyst at the age of 67; it probably developed after the menopause.

Adhesions.

Adhesions were present in 448 out of the 658 ovariotomies, i.e., in over two-thirds of the whole number.

The most frequent of the adhesions were to the abdominal wall and omentum. The most important were those to the bladder (which was opened in two cases); to the peritoneum of the pelvic cavity (leading to the exposure of the ureters in three cases and to fistula and the subsequent sacrifice of the kidney in one); to the uterus (sometimes removed on account of the dense adhesions but more often on account of concomitant disease); to the small intestine (necessitating enterectomy in three cases); and to the large intestine and especially the sigmoid and pelvic colon (for which enterectomy was performed in three cases, in addition to two cases in which the hole in the bowel communicating with the cyst was closed by suture).

Torsion of the Pedicle.

In 85 of the 658 ovariotomies the pedicle of the tumour was twisted (11·3%).

In one case the torsion had completely severed the pedicle, so that the tumour was parasitic on the adherent omentum.

In 57 the tumour was a cystadenoma, in one a solid cancer, in 18 a dermoid, in one a fibroma, in nine a parovarian. One tumour, removed within two hours of the occurrence of the torsion, showed extensive hæmorrhage into the tissues of the tube and broad ligament; two cases of parovarian cyst showed great congestion of the ovary, but not the cyst [4]; another showed great stretching and thinning of the tubal epithelium by the effused blood [5].

Ovarian Tumours Tapped before Operation.

Twelve tumours had been tapped before operation, six in my first fifty cases, six in the remaining 608; only one (an enormous multilocular cyst) has been tapped by me, to relieve the embarrassed breathing before the operation. The tapping was followed, in every case but one, by adhesions, in one case by suppuration. Except in very rare circumstances, tapping should have no place in modern practice.

Ovarian Tumours Ruptured before Operation.

Forty-one tumours were ruptured before operation. Seven of these were malignant—in two cases solid medullary cancer. The rest were cysts, of which one was a dermoid ruptured during riding exercise: two were cystic fibromata; one (a pseudomyxoma ovarii) had been treated abroad by massage for abdominal fat; four operations were performed on this patient, two for ovarian pseudomyxoma and two for pseudomyxoma peritonei, with growths in the omentum and colon; she recovered well from the operations and died from heart disease seventeen years after the first ovariotomy. Two of the patients had been treated for ascites. In one case the rupture had completely healed, without producing adhesions.

Papillomatous Ovarian Cysts.

Thirty-three benign ovarian cysts contained papilloma inside and, in some cases, outside the cyst; in addition seventeen malignant cysts were "papillomatous."

Of the thirty-three benign cases the papillomatous cyst was on the right side in 12, on the left side in 10, and the affected ovary only was removed; in 11 cases both ovaries were papillomatous and were removed, or (in three cases) the other ovary had been removed at a previous operation.

In one case in which the left ovarian tumour (ruptured), of the size of a fist, had papilloma inside and on the surface, the patient was in excellent health twenty-four years after the operation, although the affected ovary only was removed. Another patient, from whom a small unruptured papillomatous cyst was removed, together with the myomatous uterus (the other ovary being retained), remained well twenty-eight years later.

In another case, in which there were bilateral tumours of the size of coconuts, with papillomatous masses inside and outside, an exploratory operation had been carried out by an experienced gynæcologist, who, after excising a piece of the growth, declared it to be malignant and inoperable. Both tumours were removed and, four years later, a mass of papilloma was dissected off the broad ligament, and the patient was in good health twenty years after the ovariotomy.

Papilloma in parovarian tumours is mentioned later.

Dermoid Tumours.

Of the 66 patients in whom dermoids occurred, the youngest was aged 18, the oldest 67, only two being over 60. Nineteen of the patients were single. Of the married women 11 had had no child. One primigravida was delivered by Cæsarean section; in four it is not stated whether there were children or not; 30 patients had had in all 105 children (an average of 3·5), but only 12 abortions in all. The largest family (10 children and two abortions) occurred in a patient aged 42, who had a dermoid tumour as large as the pregnant uterus at six months, containing a large number of fat balls; these were present also in another very large dermoid, of the size of the uterus at term, in a woman aged 64. Thirteen of the tumours were bilateral, 32 on the right side, 21 on the left; one tumour independent of the ovaries, was contained in the broad ligament, a so-called parovarian dermoid. Three of the tumours were large multilocular pseudomucinous cysts with a dermoid loculus; one of these was ruptured and discharged twelve pints of gelatinous fluid into the peritoneum. One tumour was an endothelioma with a dermoid loculus, and one a sarcomatous dermoid [6].

Thirty-four of the tumours were adherent; 32 were free from adhesions.

The pedicle was twisted in 18 of the 66 cases (27·2%); in one the pedicle was completely divided, in another almost so. Four of the tumours were suppurating, the infection coming apparently from the adherent intestine: in one of these colitis was present, in the other the temperature was 103° F. at the time of the operation. In a third patient the tumour communicated with the pelvic colon. In a fourth the infection was caused by tapping (10 pints) and leaving the trocar in for three weeks. In one patient, recovering from typhoid, the temperature was 102° F. at the time of operation, but the tumour was not suppurating.

The tumours contained the usual sebaceous fluid and various embryonic structures and—in every case but one—hair; that tumour contained bone, teeth, and thyroid.

Particulars concerning the 15 dermoids complicating pregnancy, labour and the puerperium have been already published [2]. There seems to be some evidence that dermoids, like certain uterine myomata, diminish or retard fertility. One of the

patients had had three children and one miscarriage by the time she was 30, but no subsequent pregnancy seven years later, when bilateral dermoids were removed. Another very healthy woman, very anxious for children, was sterile for five years, when a dermoid as big as a cocoanut was removed, and a cystic ovary left behind. Eight months later she became pregnant and was delivered of a living girl, and afterwards of a boy. A few months afterwards she developed cancer of the cervix, for which perhaps I have the responsibility, having left that cystic ovary. Radium and Wertheim's hysterectomy were successively and successfully employed, for I saw the patient recently in perfect health (with sexual passion unimpaired) more than twelve years after the hysterectomy.

With regard to the operation, in all cases but one the whole ovary was removed; in that case the tumour was excised and the remains of the ovary stitched over, a practice which I think should be more common in these cases.

Ovarian Fibroids.

There were 20 of these (18 fibroma, two adenofibroma). Three of these tumours occurred in patients over 70 years of age, the oldest being 77 (adenofibroma). Two of the 20 patients were single; three of the 18 married ones had not been pregnant; the remaining 15 had had in all 65 children (average 4·3) and 17 abortions (average 1·1). One patient, aged 62, had had 11 children and four abortions; the tumour in her case was an adenofibroma of the size of a filbert, accompanied by an enormous multilocular cyst (ruptured) on the other side [14].

Ten of the tumours were on the right side, seven on the left, two on both sides; in one case the side is not stated.

In 13 there were no adhesions; in one case only was the pedicle twisted. Six of the tumours were cystic, of these two were ruptured; one, unruptured, weighed over 45 lb.

Two tumours (one infected) were removed after abortion, and one (calcified) impacted in the pelvis, was removed immediately after Cæsarean section.

In one of the bilateral cases a large fibromatous ovary was removed and a small fibroma enucleated from the other ovary in early pregnancy; the patient aborted, but subsequently had a child.

In addition to the effusion from the two ruptured tumours, free fluid was found to the extent of from half a pint to three or more pints in five of the remaining 16 fibromata (31·2%). In one case, in which there was no free fluid, the veins of the adherent omentum were very large; in another the lymphatics were greatly distended.

Besides these 20 cases of ovarian fibromatous tumours three cysts (one multilocular and two unilocular) [14] had a small fibromatous nodule in the cyst wall.

Parovarian Tumours.

There were 45 parovarian tumours, 19 occurring in single patients, 26 in married women who had had in all 36 children: the small number of children may be accounted for partly by their ages (q.v. *ante*). Twenty-five of the tumours occurred on the right side, 20 on the left. Adhesions were present in 19 cases, torsion of the pedicle in 10. The cysts were unilocular except in one (bilocular) and contained clear watery fluid, except in one which was suppurating owing to a communication with the colon. Minute papillomata were not infrequent, but only three had a mass as big as a grape. One parovarian tumour, of the size of a small coconut, was stuffed solid with papilloma—a very rare condition, so far as I know. In this, as in most of the cases, the corresponding ovary was spared; in some, in which it was inflamed as a result of torsion (*vide ante*), it was removed.

The eight cases complicating pregnancy have been published in detail, with remarks [7].

Suppurating Tumours.

There were 58 suppurating tumours, 16 occurring on the right side, 16 on the left side, 18 on both sides; in three the side is not noted. One was a parovarian communicating with the descending colon; its removal was followed by a temporary fæcal fistula, which also occurred after the removal of a suppurating papillomatous cyst. Fifty-three were ovarian cysts, of which eight were infected after labour. Some of the tumours were very large, one containing 20 pints of pus. Four of the tumours were dermoids. Two were malignant papillomatous and one a cancerous cyst. One cyst was tubercular. In four cases the cyst was infected from the adherent appendix, which was removed: in one the tumour communicated with a loop of small intestine, which with the appendix was removed [8]. Six tumours were infected through the tubes. In four cases the tumours were luteal abscesses.

In six cases hysterectomy was performed; in two others a cornu of the uterus was excised; in one for an abscess, in the other on account of inseparable adhesions: in the latter case the patient subsequently had two children. All the suppurating tumours were adherent.

Drainage was used in 29 of the cases. Five of the patients died (9·4%).

Malignant Tumours.

There were 67 malignant tumours, of which 66 were malignant ovarian tumours, and one a benign unilocular cyst, with cancer of the body of the uterus; 58 of the 66 were carcinomata, six sarcomata, and two endotheliomata. All the parovarian tumours were benign.

The carcinomata were either solid—in two cases of which (ruptured medullary cancer) the patients remained well six and seven years after removal, the latter having since had two children [9]—or adenocarcinoma, of which one (cystic and ruptured) recurred in the fat of the abdominal wall, the patient remaining well five years after the ovariotomy and three years after the removal of the metastasis—or papillary carcinoma, or malignant papilloma.

Two cases were complicated by cancer of the cervix, one of these recurred after a year, the other just over three years after the ovariotomy and hysterectomy.

One case (a benign unilocular cyst) had also cancer of the body of the uterus; the patient remained well twenty-four years after the removal of uterus and ovaries. Two cases had also cancer of the Fallopian tube; their after-history is unknown.

Two cases had also cancer of the breast. Of these one had had a pseudo-mucinous cyst removed by Sir John Williams nearly twenty-five years previously. In May, 1915, when the patient was aged 46, I removed a carcinomatous (spheroidal-cell) ovarian tumour of the right side. In February, 1921, Mr. Raymond Johnson removed the right breast for cancer; three months later there were signs of recurrence in the glands.

In the other case I had removed a papillomatous ovarian tumour of the right side five years previously. On March 27, 1920, when the patient was 68 years old, I removed the other ovary (which contained a malignant papillomatous tumour) together with 22 inches of densely adherent small intestine. The cancerous breast was removed by Mr. Raymond Johnson five weeks later, and the patient remained well in April, 1924.

Of the six cases of sarcomata one, occurring in a dermoid, has already been published in the *Proceedings* [10]; the sarcoma was a large round-cell growth. Three were spindle-cell sarcomata, one weighing 11 lb.; two fibrosarcomata. One

of these had been diagnosed, no doubt accurately, by a distinguished gynæcologist as an ovarian fibroma complicated by uterine myoma, and had been treated by X-rays, with complete success as regards the cessation of bleeding. After about five years the ovarian tumour rapidly grew and, at the operation of total hysterectomy, was found to be very adherent and vascular and to have become sarcomatous. The further history of the case is not known.

The sixth case was a fibrosarcoma, developed (as in one of the cases of carcinoma) in an ovary left at a total hysterectomy for myoma eleven years before, already published by this Society [11]. It recurred, but the growth of the metastases was checked for about three years by X-rays.

Of the two endotheliomata one occurred in a dermoid, recurred in the vagina after thirteen years [12] and again later; the other occurred in a woman aged 59, the mother of six children, who remains well after ten years.

Adhesions were present in 55 out of the 67 malignant tumours. In only one case was the pedicle twisted. Drainage was employed in 18 cases. Seven of the 67 patients died (10·4%).

The frequency of malignancy in this series, even after excluding the parovarian tumours, is just over 10%; or, if six exploratory operations for inoperable cases of ovarian carcinoma (of which three died) be added, under 11%.

I am of the opinion that the high frequency of malignancy in ovarian tumours often stated in important treatises, viz. 20 to 25%, is exaggerated, and that the error is due to mistaking benign for malignant papilloma and fibroma for sarcoma.

I have personally removed eleven papillomatous ovarian tumours which had been declared, after cœliotomy, to be inoperable and mostly malignant, by experienced gynæcologists (of whom, I hasten to say, I was one). In only one of these cases did the tumours show definite microscopic evidence of malignancy, and in that case the patient survived the removal of the tumour for four years.

With regard to the frequency of sarcoma (in this series six in 658 ovariotomies, or under 1%), it has been known since the days of Virchow to be a very rare tumour in the ovary and is, I believe, whether in that organ or in the uterus, extremely malignant, yet, in A. Mayer's Tübingen statistics [13], collected by assistants, amongst 682 cases there were 22 sarcomata (3·2%), of which 12 were stated to be spindle-cell sarcoma. The percentage of cures (Dauerheilung) in those 22 cases is given as 66·7% and, after unilateral ovariotomy, as 62·5%.

Mortality.

The total number of patients who died after operation while in hospital or nursing home was 35 (5·3%). All patients remained in bed for twenty-one days and were not discharged before the twenty-fourth day after operation. Two of the patients who were about to leave the hospital (one a case of parovarian cyst, the other a case of malignant cyst with secondary growths in the peritoneum) died suddenly from pulmonary embolism on the twenty-fourth day; two patients with malignant tumours, while still in the hospital and nursing home, died from cachexia, one thirty-four days and the other five months after the operation. Another patient, very obese, from whom a large multilocular cyst had been removed, died suddenly from syncope, apparently due to a fatty heart, on the twenty-second day. One died suddenly while under the anæsthetic (ether). Six of the tumours were suppurating, two of these being dermoids. One was a case of bilateral ovarian fibromata removed with the uterus; extensive cancer of the stomach was found post mortem. A case of large adenofibroma in a patient aged 77 has been published in the *Proceedings* [14]. Seven of the cases were malignant, six of these being cancerous with secondary growths elsewhere; one was a large sarcoma weighing 7 lb. Two of the patients were operated on as emergency cases suffering from obstruction and stercoraceous

vomiting, and in an almost hopeless condition ; three while suffering from bronchitis, from which they died ; one patient who had a large gangrenous cyst, and peritonitis and high fever at the time of operation, died of septic endocarditis and abscesses in the lungs on the fifteenth day. One died from cerebral and spinal hæmorrhage on the second day ; one from intestinal hæmorrhage (ulcerative colitis) on the eighth day. Four died from shock. In seven of the 35 cases hysterectomy also was performed, in two sigmoidectomy. One patient died from obstruction owing to adhesion of intestine to the pedicle (after operation on the eighteenth day for its relief) ; one from peritonitis on the sixth day after operation, from adhesion to gauze inadvertently left in the abdomen (removed on the third day). With this sad case, which affected me more than all the successful ones, I close my review. I hope that other gynæcologists when they retire from practice will furnish the Society with a detailed record of all their cases, so that more trustworthy statistics may be forthcoming than some of the heterogeneous ones to which I have alluded.

In the past, Spencer-Wells set a good example in publishing accounts of all his operations. His "one thousand ovariotomies," published fifty-one years ago (1882), is the largest personal record, so far as I know. Although his cases were, on the whole, less serious than those now operated on (e.g., only two of his patients were aged over 70, only twelve of the cysts were ruptured, and only three suppurating) his mortality-rate was 23·2%. We, his debtors and successors, with improved technique, have naturally had better results.

In my first 50 ovariotomies the mortality-rate was 2% ; but in the whole series it was 5·3%. The increased mortality was partly due to the larger number concerned, and partly to the greater severity of the cases, 12 out of the 35 deaths occurring after the removal of suppurating and malignant tumours.

I will end by stating my opinion, based on experience, that all benign ovarian tumours, however adherent and whether papillomatous or not, can and should be removed. Some of the benign papillomatous tumours closely resemble malignant growths : if a patient with such a tumour, thought to be malignant, is found two years after an exploratory operation to be fairly well, believe, with me, that you have made a mistake, and remove the tumour.

I also advocate the removal of malignant tumours, even in the presence of accessible secondary growths, if the condition of the patient will allow.

The last word has not yet been written on the value of X-rays and radium in curing or checking metastatic growths, but I have seen some encouraging results. If, after removal of the malignant ovarian tumour (and of affected gut, if necessary), some irremovable growth or severe oozing remains, the use of iodoform gauze, removed after ten days, is a valuable means of saving the life of the patient in these otherwise hopeless cases.

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Discussion.—Mr. GREEN-ARMYTAGE agreed with Dr. Spencer that the removal of an ovarian tumour could be, like that of the appendix, the easiest or one of the most difficult operations. In 1931 he had published in the *Journal of Obstetrics and Gynæcology of the*

British Empire[1] the findings and results of 547 consecutive operations for ovarian neoplasms. He thought that the incidence of malignancy was higher than Dr. Spencer had indicated, for his records showed that malignant changes were microscopically present in 21·4%, and—though the cases were mostly advanced and therefore the chances of malignancy were, of course, greater—this high incidence more nearly approximated the statistics of Doderlein and Lippert.

He considered that the chances and risks of recurrence in the opposite ovary, in cases of papilliferous tumours were also greater than Dr. Spencer suggested, as on three consecutive occasions when he had followed the dictum of Professor Blair-Bell to attempt conservation of the apparently healthy ovary, he had in the course of a few months to reopen the abdomen and remove recurrent tumours in the opposite ovaries. He therefore in recent years when there was ascites and a definite extrinsic type of papillary tumour in one ovary, preferred to remove the uterus with both ovaries.

The finding of pus in ovarian neoplasms was a common occurrence and he had been struck by the fact that this pus was almost invariably purely streptococcal in origin, possibly from the bowel, and therefore it was of extreme importance not to permit tapping or rupture of the tumour, lest peritonitis should follow.

He could not agree with Dr. Spencer as to the matter of keeping these cases in hospital or bed for twenty-four days, for his experience was that these patients always wanted to get out of bed early. If the incision was paramedial and catgut was used there was never suppuration, or tension on the scar and no risk of post-operative hernia. Throughout the series of 547 cases his custom was to allow the patient to get out of bed on the seventh to the tenth day and let them go home on the fifteenth day. In an experience of over seven thousand personal laparotomies, he could count on one hand the number of cases of embolism he had seen, and since he had adopted the immediate principle of breathing exercises and early active movements of the legs, chest, and arms, after coming round from anæsthesia he had had no case of embolism in a clean case of ovarian tumour, though he had seen it in malignant ones and suppurating tumours.

Mrs. IVENS-KNOWLES said that she had adopted the method of enucleation as recommended by Dr. Spencer in dealing with a case of bilateral ovarian dermoids associated with a five months pregnancy. The pregnancy had continued; a healthy child was born and menstruation returned normally. Twenty years later, however, a carcinoma of the right ovary developed, and was inoperable when discovered. This unfortunate sequel to a successful case, though it might have been merely a coincidence, had made her question the safety of the procedure.

Dr. SPENCER (in reply) with reference to Mr. Green-Armytage's practice of removing the other healthy ovary if one was affected with papilloma, referred him to the text of his review, which mentioned two patients who, after unilateral operation, remained in good health twenty-four and twenty-eight years later.

The disease might return on the other side, and malignant disease (as mentioned by Mrs. Ivens-Knowles) might return in the remains of an ovary after excision of the dermoid portion in a case of bilateral dermoid cysts; in the case of papilloma, however, the second tumour could usually be removed without much risk, and malignant growths in dermoids were rare (about 3%). The advantages of leaving one ovary, or even part of the organ were great; of this several instances were to be found in his paper.

He agreed with Mr. Green-Armytage that suppuration occurred not infrequently in cases complicating pregnancy and labour: he had met with it eight times amongst 63 tumours. He (Dr. Spencer) had pointed out forty years ago that dermoid contents might be carelessly mistaken for pus; nevertheless he did not agree with the opinion quoted by a speaker that true suppuration did not occur in dermoids (he had met with it four times in 66 cases) and other ovarian tumours, especially those complicated by pregnancy, or tubal or intestinal disease.

With regard to the occurrence of embolism, which was rather rare (three per thousand) he would not dogmatize, but would welcome the detailed account of complete series of personal cases such as he had published. Meanwhile he would, with Dr. Lochrane, express his mistrust of facile statements about methods to avoid this grave complication. One author had recommended taking five or six deep breaths every hour; personally he doubted the efficacy of even the magic number seven. He did not believe that any experienced gynæcologist (or

[1] Vol. xxxviii, p. 111.

surgeon) had never met with a case of embolism. A small series of cases, such as 300, was of no value whatever in estimating the frequence of embolism, which in this series, occurred only once in 329 cases. Cases early discharged might easily escape record. Had he discharged his patients (as one speaker did) on the sixteenth or seventeenth day, not only would he have had no case of embolism, but his total mortality rate would have been reduced from 5·3 to 4·2%.

He always ligated the pedicle and did not use clamps. He had thought that marsupialization had been completely abandoned for many years; for at least forty years he had not failed to completely remove the deep portion of ovarian cysts (often very thin and tender) by seizing the edge of the cyst with rather broad Spencer-Wells forceps, stretching the seized part over the forefinger, and cutting the cyst away from its adhesions with scissors, guided by the finger.

Section of Surgery.

SUB-SECTION OF PROCTOLOGY.

President—W. S. PERRIN, M.Ch.

[*May* 10, 1933.]

Recto-sigmoidectomy as a Method of Treatment for Procidentia Recti.

By W. ERNEST MILES, F.R.C.S., F.A.C.S.

WHEN an internal organ persists in an endeavour to become an external organ, it generally causes a great deal of trouble. The rectum is occasionally an offender in this respect; the resulting condition is known as procidentia recti and consists of an eversion and extrusion of the wall of the rectum throughout its circumference. The eversion begins at the anal margin and the extrusion may either be partial, when only a portion of the rectal wall has been extruded, or complete, when the entire length of the rectum is everted. When the whole of the rectum has been extruded the protruded mass consists of a double tube, one within the other. The outer tube consists of the rectum, the mucosa being continuous with the skin at the anal margin at the base and with the mucosa of the pelvic colon at the apex of the protrusion. The inner tube consists of an equal length of pelvic colon which has also been extruded. Between the two tubes is a prolongation of the pelvic peritoneum which forms a pouch anteriorly and at the sides, but not posteriorly. In complete procidentia the apex of the protrusion is situated at the recto-sigmoidal junction. The eversion of the bowel does not extend beyond that point, on account of the unyielding nature of the so-called recto-sigmoidal sphincter. In cases of pronounced visceroptosis, coils of small intestine descend into the peritoneal pouch, with the result that the protrusion is increased in bulk but not in length. Similarly, the extrusion of a greater length of pelvic colon than that corresponding to the length of the rectum only serves to increase the size of the protruded mass. Anatomically the rectum measures five inches in length, and when completely extruded, even allowing for some degree of stretching, the protrusion seldom exceeds six inches in length, though in bulk it varies considerably.

The repetition of the protrusion whenever there is an action of the bowels, together with the loss of control over the contents of the rectum on account of overstretching of the sphincteric apparatus, causes a great deal of distress to the unfortunate patient and gradually reduces him to a state of chronic invalidism. Almost from time immemorial the minds of surgeons have been exercised in an endeavour to devise a method of permanent cure. A great number of methods have, from time to time, been suggested but none of them have been universally successful. These methods may be divided into three categories: (1) Narrowing the anal orifice; (2) fixation of the rectum to the pelvic wall, and (3) suspension of the rectum from above, e.g., rectopexy and sigmoidopexy. Of these the method which has been attended with the largest number of successes is Mummery's operation, the technique of which is so well known that it needs no description here. In partial procidentia Mummery's procedure can be relied upon to effect a permanent cure, but in complete

procidentia, especially when coils of small intestine occupy the peritoneal pouch, recurrence of the protrusion is apt to take place after a year or two.

There is no doubt that the best and the safest way of preventing recurrence of procidentia is by performing left inguinal colostomy, but patients shrink from having to pass their motions in an unnatural way and prefer to put up with their disability. I have often remarked that many of the patients suffering from procidentia who apply for treatment at hospital are never seen again if an operation is suggested and I have no doubt that the reason for their disappearance is that their medical advisers think that colostomy is intended.

Of all the methods which have been advocated for the treatment of complete procidentia of the rectum, I have found none to afford more uniformly good results than amputation of the protruded bowel. I call the operation "recto-sigmoidectomy," by which is meant excision of the rectum together with the extruded portion of the pelvic colon. I performed the first operation of the kind as long ago as 1904 and up to the present time my experience of it has extended to 31 operations, 7 in men and 24 in women.

Technique of the operation of recto-sigmoidectomy.—The patient, having been anæsthetized—the best anæsthetic for the purpose being intrathecal percain (1 c.c. of 1 : 200 solution) combined with gas-and-oxygen inhalation—is placed in the combined lithotomy and Trendelenburg position. The rectum is protruded to its full extent, and then the following steps[1] are carried out:—

(1) Commencing anteriorly half an inch from Hilton's white line, a longitudinal incision, two and a half inches long, is made through the mucosa, and then, by blunt dissection, the mucosa is separated from the underlying muscular coat as far laterally as possible. At the lower angle of the incision through the mucosa, a pair of Kocher's forceps is placed transversely on the mucosa, on either side, so as to control bleeding from the hæmorrhoidal vessels.

(2) At the level of the upper extremity of the incision the mucosa is divided transversely on either side as far as the lateral margins of the protruded bowel, thus exposing the muscular coat of the rectum.

(3) The posterior aspect of the protrusion is then treated in a similar manner.

(4) The muscular coat of the rectum is incised longitudinally on its anterior aspect by an incision corresponding in length to the initial incision through the mucosa. The object of commencing this incision half an inch from Hilton's line is to prevent damage to the sphincters, and especially to the point of fusion between the levator ani and the external muscular coat of the rectum, upon which depends subsequent control over the contents of the bowel.

(5) The peritoneal pouch having been exposed by the incision through the muscular coat of the rectum, the pelvic colon is found to be free anteriorly, and at the sides, but attached posteriorly by the vascular pedicle of its mesentery. Should the pouch contain coils of small intestine these must be returned into the pelvis and maintained in position by means of a suitable swab.

(6) The muscular coat of the rectum is divided transversely, throughout its circumference, at the level of the upper angle of the longitudinal incision, when it will be found that the rectum can be peeled downwards, bleeding points being secured by forceps.

(7) The cut margin of the peritoneal pouch is sutured to the pelvic colon so as to shut off the peritoneal cavity completely, after withdrawing the swab, if one has been introduced.

(8) The vascular pedicle of the pelvic mesocolon is ligatured half an inch below the point where the pelvic colon is to be divided.

(9) A pair of Kocher's forceps having been placed upon the muscular coat of the

[1] These were well illustrated by means of a film made by the Kodak Company.

pelvic colon anteriorly and posteriorly, in order to prevent retraction into the pelvis, the colon is divided transversely half an inch above the ligature upon the vascular pedicle.

(10) The pelvic colon is sutured to the stump of the rectum by means of a continuous catgut suture, first muscular coat to muscular coat, and then mucosa to mucosa.

(11) As a final step, the index finger is gently inserted through the lumen at the site of the suture line, in order to make sure that there is not undue narrowing, and then a drainage tube is introduced to facilitate the voidance of flatus.

After-treatment.—The bowels should be kept confined for four or five days, and then opened by an olive-oil enema, which should be repeated daily. Strong aperients should be avoided until the suture line is quite sound. At the expiration of ten days the index finger should be gently passed through the junction. This should be repeated daily to prevent constriction.

Complications.—It might be assumed that, owing to the peritoneal pouch being freely opened during the operation, there would be considerable risk of septic peritonitis supervening as the result of *B. coli* infection. This has not occurred in any of the thirty-one cases upon which I have operated. Occasionally there is slight local suppuration in the neighbourhood of the suture line, but it soon clears up.

Mortality from the operation.—Among the thirty-one cases operated upon there has only been one death, and that was not directly due to the operation. Death was due to intestinal obstruction caused by strangulation of a loop of small intestine by a band of adhesion. The patient had, several years previously, been operated upon for ventrofixation of the uterus.

End-results.—These have been remarkably good. There has only been one case of recurrence; this occurred five years after the primary operation. The prolapse was resected, and the portion of the pelvic colon which was removed contained eleven diverticula, each of which contained a mass of fæces.

Sphincteric control gradually improves, and at the end of six months or less is usually fully restored. Much, however, depends upon the assiduity with which the patient carries out the instructions given in regard to practising contraction of the sphincters at intervals during the period of convalescence.

Discussion.—Sir CHARLES GORDON-WATSON said he believed that the operation which Mr. Miles had described as "recto-sigmoidectomy," and which in the past he had been content to call "amputation of prolapse," was the best available for advanced cases and those in which less severe operations, such as the Mummery operation, had failed.

In his own experience, which was limited to four cases, a good deal of blood was lost and some degree of shock was unavoidable. He had not attempted the operation in old people with severe prolapse as he considered that the extreme loss of tone of the pelvic floor, so often present in the aged would militate against success. It was not an operation to be undertaken lightly in old people. He would be interested to hear from Mr. Miles whether his cases included patients of this class, and if he advocated the operation for senile prolapse.

He, the speaker, had found the Mummery operation fairly efficient in the young or middle-aged, but only employed it after cauterization had failed. He believed, however, that there must always be a percentage of patients with chronic prolapse whose pelvic muscles were so relaxed that no operation would provide more than temporary relief, and this applied, he thought, to Mr. Miles's method as well as to others. He was opposed to all types of abdominal operations for this complaint.

When amputating for prolapse he laid stress on the Trendelenburg-lithotomy position to keep the intestine out of the anterior peritoneal pouch, when opened, and emphasized the importance of getting the patient to exercise the sphincters after operation and referred to the value of electrical stimulation of the pelvic floor after operation as carried out by Dr. Heald and others.

Mr. LAWRENCE ABEL said he had carried out this operation three times on human beings, and once on a prize French bull-pup—all with very satisfactory end-results. He found that patients rapidly regained tone in the sphincter muscles by voluntary exercises.

Volvulus of the Cæcal Angle.—P. LOCKHART-MUMMERY, F.R.C.S.

A girl, aged 18, was sent to me with a history of having had three attacks of pain in the abdomen. Each attack had lasted for several days and was quite severe. She had no vomiting or other symptoms. The attacks came on quite suddenly without any apparent reason. During the attacks her doctor noticed, in the middle of the abdomen, a large, firm swelling, which disappeared after the attacks had subsided. No swelling could be felt except during the attacks.

FIG. 1.—Skiagram of colon with barium enema.

Examination with a barium meal showed a remarkable condition. The stomach was pushed up to the left, and when the meal passed into the colon it was seen to go straight down the middle of the abdomen; no colon was to be seen on the right flank at all. A barium enema showed that the colon after forming a loop in the pelvic portion passed straight up to the splenic angle and then back again to the bottom of the pelvis. There were no signs of any cæcum, ascending colon or transverse colon (fig. 1).

The doctor came to the conclusion that the condition was one of floating cæcum and sent the patient to me for an opinion. The case was evidently one of a primitive state of the colon in which the cæcum had never moved over to the right side and had retained its central mesentery as in the early stages of development. The mesentery of the right side of the colon was common to that of the whole small intestine, and the whole of the cæcal angle was completely loose. I concluded that the attacks were due to a twist of the cæcal angle, and in view of the great danger of a volvulus occurring, advised operation.

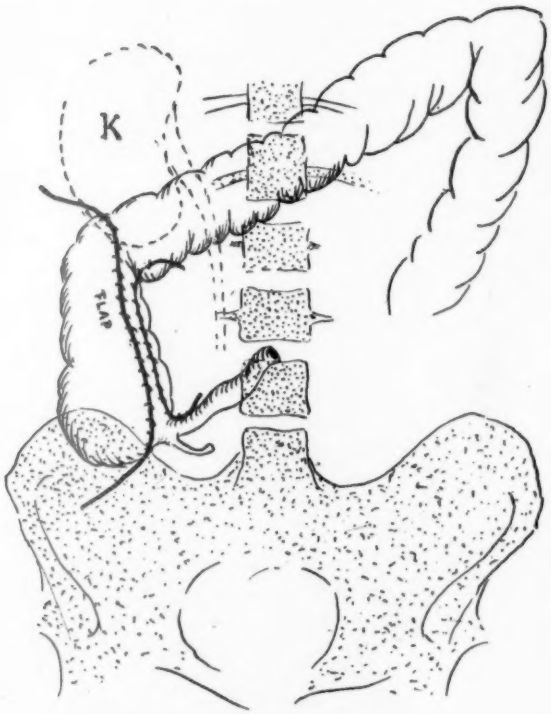


FIG. 2.—Fixation of floating cæcum.

The abdomen was opened by an oblique incision on the right side and the condition found was as expected. The cæcum lay in the bottom of the pelvis, and from there the colon passed straight to the splenic angle, having a mesentery common to the whole of the small gut. There was quite a band of lymph and inflammation passing right round the cæcal angle and small gut at the point where a partial twist had occurred, but no twist was present at the time of the operation. A large flap of the posterior peritoneum was raised, passing over the lower pole of the kidney and carried down to the brim of the pelvis with its base outward towards the flank until it exposed the right ureter and the main vessels (fig. 2). The cæcum

and part of the vertical colon were then displaced to the right side behind the flap and the front edge of the flap was carefully sewn to the anterior muscle band of the colon all the way along. The edge of the peritoneum on the inner side was then brought up and stitched in a similar manner to the inner edge of the colon. This was carefully fitted round the ileocæcal junction to prevent any strangulation at this point. The abdominal wound was then closed.

The patient made an uneventful recovery and the bowels acted smoothly from

FIG. 3.—Three weeks after fixation of cæcum.

the beginning. Skiagrams taken since the operation show the cæcum in its normal position and apparently firmly fixed (fig. 3).

I believe this to be the first case of floating cæcum diagnosed and treated before a serious strangulation occurred. A great many cases of volvulus of the cæcal angle are recorded, nearly all of them fatal. The amount of gut included in the volvulus may be very considerable, and include nearly all the small intestine, the commonest twist being from the left to the right, i.e., anti-clockwise. Thus out

of fifty cases collected by Flatin, thirty-five were anti-clockwise, and only fifteen clockwise.

Volvulus of a Mega-colon.—P. LOCKHART-MUMMERY, F.R.C.S.

The patient was an elderly man, who was suddenly seized with intestinal obstruction. I saw him forty-eight hours after the onset. There was enormous distension in the abdomen, and enemas completely failed to produce any result. There had been vomiting up to the time of operation.

An immediate operation was carried out under avertin and regional anæsthesia. A small incision was made on the right side, and a rubber tube inserted into the dilated loop of colon with a purse-string suture. The distended loop of colon almost filled the abdominal cavity, and was so tight as to render it quite impossible to ascertain exactly what the state of affairs was. This gave immediate relief to the distension, and a barium enema was then given to ascertain exactly what was the matter.

It was then seen that there was an enormous loop of pelvic colon almost filling the abdomen, and when the distension had subsided a further operation was performed as an effort to relieve the cnodition.

It was found at this operation that there was a mega-colon of the entire pelvic loop. The apex of this loop reached under the surface of the liver, and the bowel was nearly five inches in diameter. The walls were very thick and tremendously hypertrophied. The condition had evidently been in existence for years, possibly since birth, and there were a great many adhesions, and much thickening in the mesentery. The loop was partially twisted, and had obstructed the lower end of the ileum, but there was no strangulation of the blood supply. The loop was brought out of the abdomen and cut off, leaving the two ends in the wound. This was done as rapidly as possible, as the patient was in very poor condition. Unfortunately he died, in spite of everything that could be done, three days later.

This case is a very unusual one; not many cases of volvulus of a mega-colon have been recorded. It is also remarkable that the patient should have lived to a considerable age without any very definite symptoms of the condition.

Abdomino-perineal Excision of the Rectum and a Modified Wertheim's Operation for Carcinoma.—CECIL JOLL, M.S.

The specimen shows a portion of the sigmoid, the rectum, the cervix uteri and the upper two-thirds of the vagina, removed from a patient aged 56 for carcinoma of the rectum. The body of the uterus had been removed ten years before on account of fibroids. The abdomino-perineal operation had to be extended to include the portions of the genital tract removed in order to embrace an extension of the disease into the posterior aspect of the cervix. The patient left the nursing home with the perineal wound rapidly healing, seven weeks after the operation.

Carcinoma of Colon in a Girl, aged 17.—CECIL JOLL, M.S.

The specimen is a transverse colon with a portion of the omentum removed from a girl aged 17, who had lost 2 st. in weight and had suffered from abdominal pain and severe secondary anæmia. At the centre of the portion of gut removed is a short intussusception caused by a polypoid adenocarcinoma. An end-to-end anastomosis was performed between the ascending and descending colon. The patient put on 3 st. in weight within six months and her hæmoglobin rose from 29% to 85%.

Diverticulitis of the Cæcum.– CECIL JOLL, M.S.

The specimen is a cæcum and portion of the ascending colon and the lower few inches of the ileum, removed from a man aged 37, who had had several attacks of abdominal pain and pyrexia suggesting acute appendicitis. The specimen shows a diverticulum on the posterior aspect of the cæcum, surrounded by a thickened mass of inflammatory tissue which simulated a malignant growth. The ileum and transverse colon were anastomosed end-to-end and the patient was able to leave the nursing home within three weeks of the operation.

Section of Psychiatry.

President—HENRY DEVINE, M.D.

[*May* 9, 1933.]

The Significance of Small Measurements in Mental Disorder.

By CLEMENT LOVELL, M.D.

ABSTRACT.—Measurements must be outside the limits of experimental error.

Clinically it is seldom possible to make a series of measurements of the same material.

Hence the accuracy of a method must be previously determined in the laboratory.

Small degrees of physical abnormality have an importance in mental disease which they may not possess in the wards of a general hospital.

Examples discussed: Latent jaundice; mild degrees of uræmia; lymphocytosis.

IN clinical work it is seldom possible to make a series of measurements on the same material, as not only is the quantity of material generally limited, but the material may autolyse, or disintegrate during the experiments, and so give rise to erroneous results.

This difficulty may be overcome by a preliminary trial of the method on a large quantity of uniform material, so that we shall not subsequently be led astray by results which fall within the limits of experimental error.

The limits of health are generally determined by observation on a large number of cases.

I have chosen for discussion two or three groups of cases, in which, I submit, we are not attaching sufficient importance to the indications of the laboratory tests.

In a person with a bad heredity, or subject to severe stress, very slight physical disease may upset the mental balance, and it may be important for us to pay attention to small degrees of physical abnormality, which might not merit consideration in the wards of a general hospital.

Latent jaundice.—The first subject for consideration is latent jaundice. Here the presence of bilirubin in the serum is detected by the van den Bergh test, or some modification of it, such as Thannhauser's, and the quantitative estimation is made against a cobalt standard. The measurement is subjective, and rather crude, but it is easy to distinguish the cases with 1, 2, 3, or 4 units of bilirubin, the unit being one part in 200,000.

I have here an analysis of the last 500 cases, in which the test was made in the course of a routine examination; 310 were in the wards of the Bethlem Royal Hospital and of these 63 gave a positive reaction. The remaining 190 were private cases, and 42 gave positive results—about the same proportion. Of the total, 105, which gave a positive result, I have taken 63 cases, and excluded three, in which there was a direct reaction, as these were surgical cases. Of the remaining 60 cases, I have been able to follow up 50. It must be understood that all these cases received the routine ward treatment for constipation, and its associated toxæmia. The amount of bilirubin present in the serum was as follows:—

1 unit	16 cases	3 units	12 cases
2 units	20 ,,	4 ,,	11 ,,

Of these 50 cases, eleven received special treatment for this condition, either glucose or bile salt. Ten showed an immediate improvement, one showed no improvement. Of the 39 cases without any special treatment, two improved shortly after giving a positive van den Bergh reaction, while 37 showed no change.

I am not now concerned with the ultimate fate of the patients, because that will depend upon many other factors. What I wish to establish is that the presence of 1 unit or more of bilirubin in the serum lifts these cases out of the category of common intestinal toxæmia into a much more serious group, which calls for a special line of treatment.

Urea retention.—The second group consists of cases with urea retention, and evidence of renal disease (albumin and casts in the urine).

In a preliminary examination we found a mean reading of 42·2 mgm. per 100 c.c., with a probable error of ± 1·26.

In a series of 162 consecutive cases, all in the hospital wards, thirteen had albumin and casts in the urine with more than 50 mgm. of blood-urea per 100 c.c.; two cases had from 50 to 60 mgm.; seven had from 60 to 80; four had upwards of 80 mgm.

Of the thirteen patients, one recovered, two improved, three did not improve and seven died.

The salient symptoms were: In eight cases, confusion; in two cases, emotional instability; in one case, sleeplessness.

Lymphocytosis.—In routine laboratory work we have generally to be content with the examination of blood films, following them up with a full count when indicated. The most useful figure here is the lymphocyte count.

A lymphocytosis is absolute or relative. It used to be taught that a polymorphonuclear leucocytosis implied an acute infection except in certain established cases, such as typhoid fever, measles, influenza, etc.

An absolute lymphocytosis implied some chronic infection; relative lymphocytosis implied a polymorphonuclear leucopænia, as in Addison's anæmia.

It is now considered that a lymphocytosis is not an indication of chronicity, but rather of repair, implying that an infection is being resisted; post-infective lymphocytosis is now well recognized.

Let us now consider how a differential count may help us in elucidating physical factors in mental disease.

I have taken 100 consecutive cases all seen in private practice. Ten had a relative lymphocytosis of over 50%. Seventeen had a relative lymphocytosis of 40 to 50%.

The ten cases with a lymphocytosis of over 50% proved, on further investigation, to be cases of: (1) Suppurating gall-bladder; (2) suppurating maxillary antrum; (3) chronic appendix abscess; (4) septic abortion; (5) tonsillitis; (6) obscure enteritis; (7) pituitary tumour; (8) asthma; (9) tetany; (10) intestinal stasis.

The 17 cases with from 40 to 50% lymphocytes: Cholecystitis two; dental sepsis two; tonsillitis two; chronic appendicitis one; unresolved pneumonia one; asthma two; *B. coli* cystitis two; endocarditis one; old syphilis one; renal disease one; colitis two.

In two cases a low relative lymphocyte count drew attention to a neutrophile leucocytosis, with an acute infection.

One interesting feature is the result of agglutination tests. Sometimes when a septic focus cannot be found, agglutination tests may give an indication. In nine cases of the 100 a specific agglutination was given to some organism.

In every one of these cases the lymphocyte count was only slightly raised. Antrum infection, two cases, 44%, 21% lymphocytes. Arthritis and rheumatism four cases, 25%, 34%, 29%, 34%. Paratyphoid A, one case, 28%. Endocarditis, one case, 40%. Disseminated sclerosis, one case, 33%.

The Physiological Basis of the Neuroses.

By W. Ross Ashby, M.B.

Abstract.—In many ways in physiology and psychology one sees evidences of "patterns." Sensory stimuli are usually received as a pattern and most motor responses take the form of a clear-cut pattern of movements. The majority of the reactions in the central nervous system are concerned with *patterns* of impulses rather than a single nerve impulse.

It is suggested that when two patterns meet, the interaction is subject to two definite laws:—

(1) Similar patterns integrate and become one pattern, the differences between them building up to a new pattern.

(2) Dissimilar patterns are dealt with by the complete acceptance or establishment of one pattern and the total rejection of the other.

Examples are given to illustrate these two laws.

It is suggested that whether two patterns are treated as similar or dissimilar will depend on: (1) The nature of the patterns themselves and; (2) the state or type of the nervous system.

It is suggested that in the neuroses, what is really happening is that the person is treating as dissimilar certain patterns which are usually considered to be similar.

Clinical applications are discussed.

This paper really follows as a development of ideas put forward by MacCurdy in his book "Common Principles in Psychology and Physiology." MacCurdy has come to the conclusion

that the only way to combine physiology and psychology is to work, not in terms of impulses, or synapse resistances, etc., but in terms of "patterns." He calls them "images" and "patterns," apparently using the words as equivalent.

He finds that the same basic properties of patterns are shown both in psychology and in physiology. He finds that patterns in various forms occur freely in both sciences and he concludes that exactly the same basic rules hold good in both spheres.

MacCurdy's considerations of patterns were of great interest to me, as I had already and independently come to somewhat similar conclusions. In this paper I propose to accept his general outline and to attempt to develop his ideas a stage further. I hope to show that if MacCurdy's ideas are extended we shall find that the neuroses fall quite naturally into their place in the scheme. MacCurdy is, I think, deliberately vague in his definitions of images or patterns, preferring to leave the concept to the reader's general understanding rather than to tie the concept down too rigidly by definition.

I will commence by giving some illustrations of the way in which the idea of "patterns" may be used in psychology.

Firstly, the *Gestalt* psychologists have shown clearly that ordinary sensory data are by no means a mere mass of isolated point stimuli. On the contrary, it appears that under all ordinary conditions, the sensory data always present themselves essentially as patterns which have unity and interconnections. Thus, in reading, each word is essentially a pattern of black on white. It is not a mere jumble of black particles on white. It is the pattern formed that counts. Equally a word is not the same as a jumble of letters. The letters must form a particular pattern to be of any use. Thus, if we take the word "veil," and if we arrange the letters in varying orders, we get "VILE," "LIVE," "VEIL," "EVIL," "LEVI." These words contain the same four letters but they are read quite differently. Consequently, in reading we are not reacting simply to the letters E, I, L, and V, but we are reacting to the pattern formed by them.

Equally in hearing speech, we are dealing with patterns of sound. Here again, it is the pattern which counts. The loudness or pitch of the voice counts little. We can understand people who speak in a deep gruff voice and also if they have a high squeaky voice. But if they are to be understood, they must produce the right pattern of sound.

In vision, at least, practically all our data is given to us in the form of patterns. In hearing, we deal largely with patterns of sound. At a further stage of the process, these sensory patterns are built up into larger and more comprehensive patterns as when we are "conversing" with someone. We see the person moving his lips and see his expression and also hear the patterns of sound which he is producing. Equally, from this conversation, still further patterns are produced when we have listened for some time, and have had built up in our mind the pattern which the speaker has been trying to construct.

Similarly, at the other end of the process we have muscular movements, which, it should be noticed, appear normally as patterns. A person in convulsions is producing movements which are almost patternless, but any useful movement must be adjusted to produce a definite pattern. In making a drive at golf, for instance, a very particular pattern of movement must be produced in order to get a good drive. In speaking, too, we must produce very precise patterns of movements of our tongue, etc., in order to produce the patterns of sound which we want.

Further examples would be mere repetition, but in any case it is clear that the concept of patterns is capable of wide extension in psychology, as has been suggested by MacCurdy.

Here I propose to maintain that these patterns have certain general properties, which will apply to all patterns equally. I submit that all patterns follow two general rules, and that these two rules apply to patterns both in psychology and in physiology. The rules deal with the interactions of patterns with one another and are as follows:—

(1) Nearly similar patterns will always fuse into one another as far as possible, so as to give one pattern, made by combining the common parts of the two, and the small differences between them, if systematic, will give rise to a further, and brand-new pattern.

(2) Dissimilar patterns will not fuse, but will struggle, one with the other, without combining, and one of the two will be obliterated.

What evidence is there on the subject?

Let us take the first principle.

I have tried to find an example which I can demonstrate. I have only found one, which is illustrated in the accompanying figure. Here we have two simple patterns which are

certainly similar (fig. 1). At the same time there is a slight systematic difference, since in one, the bars are slightly closer together than the other. When we combine them by superimposing them we get a different pattern (fig. 2). As we have suggested before, the steady systematic differences have formed a new pattern, which is beginning to show a brand new feature, namely a wave-like appearance of alternate dark and light. We see that the two original patterns, when combined, have given us one pattern as far as the common elements are concerned, i.e., the final pattern is still a rectangle, and has bars across it, while the slight systematic difference of spacing has given rise to a brand new pattern of waves.

What examples are there in physiology?

Now in vision, we find this rule very clearly substantiated. If we look at a very distant object, each eye receives practically the same image or pattern. But these two patterns, in practice, always fuse so that the final result is that we see, not two equal patterns, one for each eye, but simply one pattern, which is the landscape we are looking at. The two

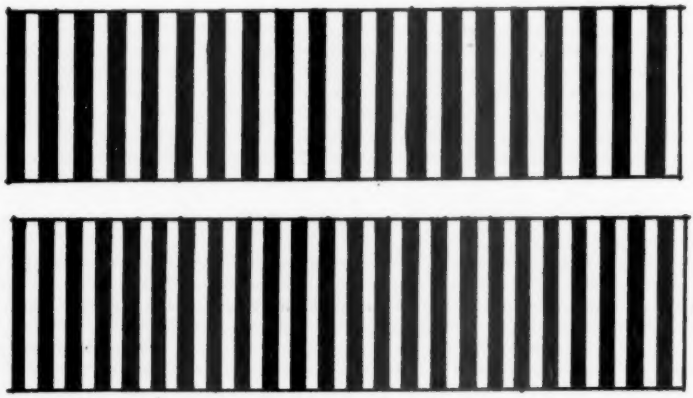


FIG. 1.

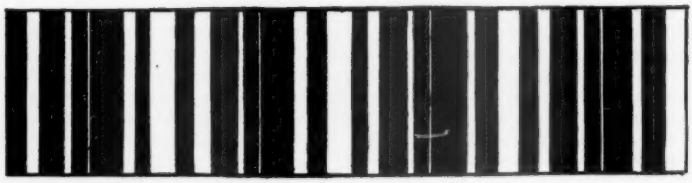


FIG. 2.

patterns have fused completely. If now we look at closer objects, the two patterns are nearly the same, but not quite, since binocular vision introduces a stereoscopic effect. Further, these differences between the two patterns are systematic, in that the amount of difference is proportional to the reciprocal of the distance. Consequently, according to the rule, we would expect the two patterns to fuse as far as their common elements are concerned, and this is found, since again we see only *one* object although, each eye contributes its pattern, while at the same time, the differences, being systematic, produce a brand new pattern, which is the concept of "distance." In vision, therefore, we find very obvious confirmation of the rule.

In hearing, we find that if the source of sound is in the sagittal plane, the pattern heard by each ear is identical, and we hear just *one* sound. But if the source is on one side, then the two patterns are nearly similar, but there is a difference, and this difference, being

systematic, in that it agrees with visual experience, builds up the new concept of "direction."

In the case of taste uniformly distributed over the tongue, again we find that the many impressions from the taste buds, being identical, are fused into one impression of taste.

A similar phenomenon is seen in the spinal reflexes when two nerves, producing the same effect separately, are stimulated together. We find, not the sum of the two separate results, but merely a slight increase of the single response. The two patterns of stimulation being nearly identical, have produced only a little more than the result of one of them. The two stimulations, of course, cannot be made precisely identical, since one has to use two nerves.

If we turn to more complex patterns, we find the same rule to apply. Suppose I were to begin saying "To-night is cold, to-night is cold, to-night is cold . . . " and so on for twenty times, and were then to ask what I had said, you would probably reply that I had said "To-night is cold" and you would probably add that I had repeated it twenty times. Here we have twenty patterns of sound, all identical in form, but differing systematically in that some were said before others. The final result is that all twenty are grouped together in your mind as far as their common content is concerned, while the differences, being systematic, build up the new idea of "repetition." Thus we see as before, that the presentation of a number of patterns, nearly identical, leads to a fusing of all the common elements, together with the development of a new concept or pattern.

I will give one more example. Suppose I am walking in the country and want to get to London. I come to a cross-roads. I see a sign-post which says "To London" and points to the right. I ask a bystander and he says "Turn right." I then look at the map and see I must turn to the right. Here I have been subjected to *three* stimulus patterns, each of which, by itself, would arouse the motor pattern of turning to the right. What actually happens? Do I turn to the right three times? Do I turn to the right with three times the muscular violence? Of course not. To another observer my motor behaviour is the same as if I had been subjected to only one of the stimulating patterns. The three motor patterns being identical, simply fuse to become one pattern.

To conclude the first part, we find, then, that many examples show the same rule with regard to what happens when two or more similar patterns are activated in the nervous system. We find that the patterns fuse and form just one pattern, which is composed of the common elements, and that the differences, if systematic, go to build up a brand new pattern.

We will now turn to the question of what happens if two very different patterns are brought together. We might think at first sight that the nervous system would fit them together as best it could and that it would have to be satisfied with the very muddled pattern resulting. Actually, however, something quite different seems to occur. Suppose we try a simple experiment. We look down a microscope keeping both eyes open, so that one eye sees the field of the microscope, while the other eye sees the table. An unpractised person sees each field of view alternating with the other. First one sees the microscope field completely, then suddenly it vanishes and one can see nothing except the table, and so on.

We find, therefore, that when two incompatible patterns are presented, or stimulated together, what happens is that one pattern appears completely, while the other is completely suppressed.

Another example is given in vision when we examine a person suffering from chronic strabismus. Since the axes of the eyes are not parallel, the pattern presented by one eye will be shifted over the pattern presented by the other. When shifted in this way the two patterns become incompatible. In such cases, as is well known, one eye becomes functionally blind. Now this is an amazingly clever thing for the visual cortex to do. It should be noted that it is not an inhibition of one side of the visual cortex, since this would produce a hemianopia. Both sides of the brain receive both patterns, and they then pick out entirely the elements coming from one eye, and reject entirely the elements coming from the other eye. How it is done is, I think, a complete mystery, but we are not concerned with that here. The fact remains that, when two incompatible patterns are presented, one is rejected while the other is accepted.

The same sort of behaviour is shown well in the spinal reflexes. As is well known, if two incompatible reflexes are stimulated together, we do not get a muddle of both of them, but instead, a complete suppression of one, and a complete expression of the other. One is rather reminded of a see-saw, with a reflex at each end so that only one can be "up" at any one moment.

Again, we see the same sort of thing in conditioned responses. If a dog is conditioned to salivate at a high note, and not to salivate at a low note, and if then we sound a note in

between them, this note will stimulate both the excitatory *and* the inhibitory responses at the same time. The dog then shows signs of acute conflict, but the interesting point is, as Pavlov has noted, that the result is always either copious salivation or none whatsoever, *never* slight salivation. That is to say, the dog always goes to one extreme or the other. Here again we see that when two incompatible patterns are stimulated together, we get full expression of one and total suppression of the other, never a half-way result.

When we come to deal with the more complex patterns involved in the concepts of "personality," "character," etc., we find much the same state of affairs. In dealing with cases of multiple personality, Morton Prince shows clearly how the various personalities in one patient are incompatible with one another. The interesting part from our point of view, is that these personalities, when brought out by hypnosis, show just the same features as before, namely, that as soon as one comes into the field, the others automatically disappear. One is reminded again of the see-saw.

Finally, when we come to ordinary behaviour, we find that this rule covers a large amount of our activities. Suppose, for instance, that it is a fine afternoon and one is not sure whether to play golf or tennis. It is quite clear that whatever one does, we shall not go to the tennis court in plus fours. The two patterns of behaviour, being incompatible, do not mix into a muddled half-way pattern. Whatever I do, it would be either one or the other, but not a half-way mixture. Again, if I arrived at tea both hungry and thirsty, and wanting both to eat and to drink, I would not take a cup of tea and then try to bite a piece out of it.

Obviously with a little ingenuity one could multiply such examples indefinitely. But in every case we find that when two incompatible lines of behaviour are activated, we get either one or the other.

To recapitulate, we found first that *similar* patterns are integrated into one another to give *one* pattern. We then found that dissimilar or incompatible patterns are dealt with by the nervous system which accepts one and rejects the other. Further, the examples have shown that these two laws hold good over a very wide range in the central nervous system. It is possible that they may represent really basic laws of the nervous system.

Well then, where do the neuroses come in this scheme? It is fairly clear after these remarks, that some of the main features of the neuroses are due to the fact that the person has in him two sets of behaviour patterns which just will not fit. The result, in accordance with our rules, is a more or less complete suppression of one set. We may, if we like, call one the unconscious and the other the super-ego, but that is immaterial. The essential point is that the person has two sets of behaviour-patterns which will not fit into one another. On the one hand, there are the primitive instinctual patterns, more or less complete in themselves, and on the other there are the larger behaviour patterns concerning family and social pressure which demand equally that only certain behaviour patterns are permissible. In the normal person, these two sets of patterns are fairly similar, so that they are dealt with by rule 1—"that similar patterns shall integrate," and in the normal person these instinctual and social patterns are integrated together to produce the normal adult, whose behaviour corresponds to a good solid integration of all the patterns concerned, so that both instinctual and social demands are satisfied. The neurotic, then, is essentially a person who, having these two sets of patterns to deal with, treats them by rule 2, i.e., by suppressing one of them, instead of following rule 1, i.e., integrating them. The point which I want to make is that the basic feature of the neurotic, namely repression, is not specialized and isolated and "abnormal," but is a feature which can be observed quite generally all over the nervous system. The neurotic suppresses one pattern. But we saw that the rule about suppressing one pattern can be observed in vision, in strabismus, in the spinal reflexes, in the conditioned responses and in ordinary, strictly normal behaviour.

But this might make it appear as though the neurotic is as normal as the ordinary person. Clearly the neurotic cannot be considered entirely normal. What is he then, normal or abnormal? I think the answer is something like this:—

Each person after birth has two sets of patterns to deal with, the instinctive and the social. As we have seen, there are two ways in which they may be dealt with, the two patterns may be integrated or one of them may be suppressed. Each of these two ways must be considered to be perfectly normal. Now the normal person says, so to speak, "these two patterns seem to me to be fairly similar so I will integrate them." The neurotic on the other hand says, so to speak, "these two patterns seem to me to be dissimilar so I will suppress one." In other words, the neurotic is abnormal, not because he chooses an *abnormal* method, but because he chooses rule 2 for dealing with the patterns, whereas the

bulk of us use rule 1. The neurotic, therefore, is not really abnormal—he is unusual, he is out of the fashion.

It will be seen that the question now becomes "Why does the neurotic find his two sets of patterns dissimilar?" Now here, it should be noted, absolute values are of no use. We are not discussing whether the two patterns, the instinctual and the environmental, are similar or not—we are noticing whether a particular person considers them to be similar. Consequently the person's reaction to them will depend partly on the patterns themselves, and partly on the nature of the person. This point of view is, I think, closer to the truth since it fixes the onus of neurosis equally on the person and his environment. Unfortunately, too many schools have thrown the onus entirely on to one or the other. Some think the neurotic is entirely the product of an infantile experience, and say that the person is neurotic because of an event or events which happened to him. Others go to the opposite extreme and maintain that he is a neurotic of his own nature. I maintain that *both* are right—that the neurosis is a product of the individual *and* his environment. It seems to me to be rather like carrying a load. Whether a person can carry a given load or not depends equally upon the weight of the load and upon the muscular strength of the person. One cannot say that all people who cannot carry their loads are abnormal—their loads may be too heavy. Equally the loads are not everything, since in some cases the people may be muscularly weak. It is not the weight of the loads, or the strength, which counts; it is the relation between them.

Another analogy is the question of obstructed labour in childbirth. What counts here is not the absolute size of the fœtal head, or the size of the pelvic outlet, but the relation between them.

In the same way, the child, faced with his instinctual and environmental patterns, will harmonize them or not according to (1) how similar they happen to be, and (2) his power of harmonizing or integrating.

So I would suggest that the ætiology of neurosis may be approached from the following point of view: The higher material of mind may be considered as equivalent to patterns. Further, the interaction of patterns always takes place subject to two rules which reign quite uniformly from the highest activities of the mind down to the simplest spinal reflexes. If the person's integrating powers are sufficient to enable him to integrate two given patterns, then they are dealt with by rule 1. If the person's integrating powers are insufficient for the particular patterns in hand, then rule 2 is used. Further, I would suggest that instinct and environment are equivalent to patterns. In the nature of things, there must always be some discrepancy between these two. If the discrepancy is greater than the person's integrating powers can manage, then they are dealt with by rule 2, and the person is considered clinically to be neurotic.

All the above, however, sounds "very much up in the air," and it needs justifying. In what way is it likely to be of use?

Although these ideas are highly theoretical, yet I think the theory may claim a hearing because it unifies a number of different ideas and brings, perhaps, some clearness where there has certainly been some confusion. Firstly, it brings the question of neurosis right down to physiology. It attempts to show that exactly the same principles hold good from the lowest reflex to the most complicated activities. There is no doubt that psychology, in its recent advances, has tended to become rather isolated and aloof from the other sciences. And yet it must be clear that psychology is really only a particular branch of physiology. It may be very complicated, and will probably always remain a special branch, but none the less, it must ultimately submit to being reduced to physiology, just as the latter, in its turn, can be reduced to physics and chemistry. In this paper I have attempted to show, if we admit the concept of patterns, that there is a complete grading of the facts, from the simplest to the most complex, from simple physiology up to the more complex psychology. The theory, then, has this advantage, that it emphasizes and recognizes the essential unity of the two branches.

A second advantage is that it recognizes and emphasizes the fact that we do not react to unit stimuli or to single nerve impulses. We always react to complete situations or patterns. The older psychologists were apt to consider that we reacted to *a* stimulus. This I believe to be totally wrong. Suppose we take an example. I am here reading. What is the stimulus to which I am reacting? The older psychologists would have said "To the print." But this is assuredly not so. I have seen this print several times before but I did not at once get up and start reading it every time I saw it. Clearly I am also reacting to the fact

that I am in this room. But I have been in this room earlier without reading the paper. Clearly I am also reacting to the time. But had I been here at 9.30 last night I should not have begun to read it. I am also, therefore, reacting to the fact that it is Tuesday, May the ninth. There are probably still further factors, but at any rate it is clear that I am not reacting only to the print—I am reacting to the whole situation, to the complete pattern of stimuli of time, place, print, date and so on. Clearly, people react to the situation as a whole. That is to say, they react to a complete pattern. I would suggest that the above line of approach to the subject of neurosis is more correct because it accepts this and deals, not with how people react to a unit stimulus, but how they react to patterns.

Incidentally, it must be obvious that this approach to the subject of neurosis is essentially that of the *Gestalt* psychologist. The theory may, perhaps, claim the advantage of introducing *Gestalt* principles to psychiatry.

Finally, there is one other more practical point which I would like to mention. According to the views expressed above, the neurotic is essentially like a porter who cannot lift a trunk. There is disproportion between the weight of the load and the strength of the porter. Similarly the neurotic is a person who cannot integrate two patterns. The person's integrating powers are too weak to reconcile the differences between the patterns. Can we test this experimentally? Now, at present, we have no means of measuring patterns or their similarities. But if what I have suggested is true—namely, that this combining activity is essentially the same from spinal reflexes, through vision, conditioned responses, and so on, up to the most complex behaviour, then it should be possible and justifiable to measure the integrating capacity at the lower levels and in that way to obtain some idea of the integrating capacity at the higher levels.

To summarize finally: As human beings, we react always to patterns. And we react to patterns of stimuli by producing patterns of movement. From this point of view, *patterns* become the essential content of the mind and brain. I have suggested that these patterns are dealt with by fixed rules. In particular we have considered what happens when two patterns are activated which would each use the same "final common path." There are two rules: (1) Similar patterns are integrated to form one pattern; (2) dissimilar patterns produce conflict resulting in the expression of one and the suppression of the other.

The child has two main facts to deal with, its instincts and its environment, and these two facts may be considered as patterns. If the environment is very dissimilar or conflicting with its instincts, or if the child has poor integrating powers, then it finds them dissimilar and reacts by rule 2. It is then described as "neurotic." But it is emphasized that this is really quite physiological. A neurosis is abnormal only because it is unusual.

Discussion.—Dr. CLIFFORD ALLEN: I should like to criticize Dr. Ross Ashby's interesting paper, inasmuch as it is, like all the configurational psychology, purely descriptive. It tells us absolutely nothing new. The configurational school of psychology takes a perfectly commonplace phenomenon—such as the formation of a row of dots to make a line—and describes this in mysterious terms. This school does not tell us the mental mechanism involved in making a row of dots form the line, but this is what we want to know.

Dr. Ross Ashby has given us Freud in terms of the *Gestalt* school, but whether we call complexes "patterns" or any other name does not make our work any easier. We shall still have to spend hours of work uncovering and "digging out" these patterns. What we need is not a new name but a new method whereby we can uncover the patterns or complexes without hours of apparently wasted toil.

Dr. A. T. WILSON said that he welcomed Dr. Ross Ashby's paper as an attempt to elaborate, using MacCurdy's "pattern" nomenclature, a practical hypothesis regarding neuroses. A great volume of physiological research was at present being done in various psychiatric institutions, and it was important to realize the general agreement among physiologists that mechanical neurophysiology was unable to explain the relatively simple phenomena of the "spinal reflex arc," far less those of the complete organism. One of the most valuable points of the pattern hypothesis lay in the fact that it provided a common language for discussion between physiologists and psychologists. Not least, it was in line with the present apparently definite monistic trend of philosophy.

Section of Urology.

President—HUGH LETT, C.B.E., F.R.C.S.

[*May* 25, 1933.]

DISCUSSION ON PER-URETHRAL TREATMENT OF THE ENLARGED PROSTATE.

Mr. John Everidge: Per-urethral methods of treating the enlarged prostate have remained in the background in this country, partly, I think, on account of the popularity of the valuable operation of suprapubic prostatectomy. We must, however, remember the early disasters in this operation—through faulty technique and imperfect knowledge of the anatomy and pathology of the enlarged prostate—which followed attempts to remove intravesical projections while the extravesical enlargement was allowed to remain and to cause an even greater obstruction than existed before. Per-urethral technique being, until recently, concerned with intravesical projections alone, must, therefore, as Sir John Thomson-Walker warned us here a year ago, risk a retrogression to the methods of those days before the anatomy and pathology of the enlarged prostate were fully understood.

Personal experience.—The series which I have treated during the last six years and a half is a short one, since under 10% of the prostate cases I see come within the scope of those suitable for per-urethral diathermy.

Present-day methods aim mainly at the removal of obvious projections, and the essential factors common to them all are perfect visualization of the parts to be removed, an adequate agent for removal—namely, a coagulating electrode or knife, punch—or an endothermy cutting loop, and a certain means of procuring hæmostasis with the aid of the diathermy current. Thus, three ways are open to us, they are:—

(1) Simple diathermy electro-coagulation, the direct outcome of the discovery of Edwin Beer, and varying little from his well-known method of destroying papillomata. The Collings-knife technique is merely a variety of this.

(2) Diathermy punching.—Here the glandular projection is either coagulated before punching, to render it anæmic, as in Walker's, Kirwin's or Bumpus's methods, or as in Caulk's method, where hæmostasis is procured after punching, by diathermy coagulation.

(3) Resection by the endothermy wire electrotome in the methods developed by Davis, McCarthy, Stern and Canny-Ryall.

(1) I began to use electro-coagulation in 1926. I subsequently designed electrodes stiffer in the shaft than those used for fulguration and possessing spear-pointed ends to allow of easily transfixing the prominent lobe. I have found the Wolf's cysto-urethroscope suitable. The visibility it supplies is excellent, allowing easy survey of the whole bladder-neck; the irrigation system works well, and the control of the electrode is simple. The first of my recorded cases treated in this way was in January, 1927. The patient had a residual urine of sixteen ounces and had had two attacks of acute retention. He has had absolutely no trouble since,

and the other day his doctor wrote, in answer to my questionnaire, that a catheter revealed no residual urine. Electro-coagulation has been my sheet anchor, and I have often resorted to it for cases in which, when using alternative methods, I did not feel that I had adequately overcome the obstruction. The objections levelled against it are two :—

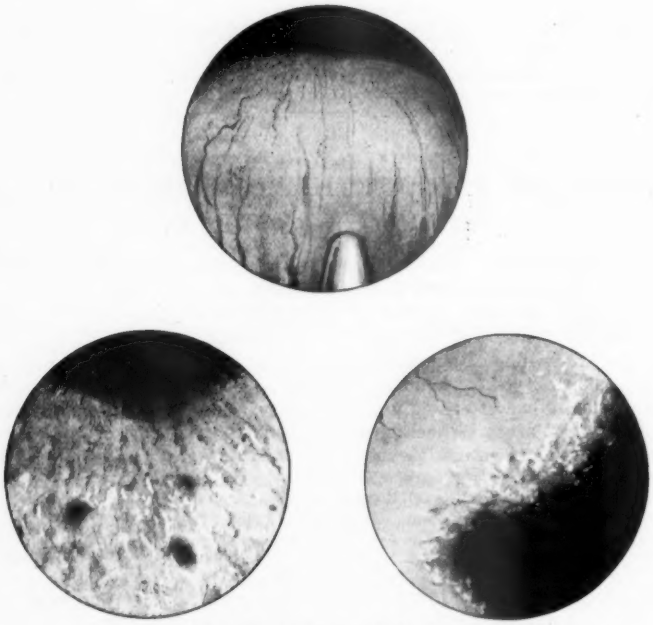


FIG. 1.—To illustrate electro-coagulation by "spearing."

This series shows the electrode entering the middle lobe, the middle lobe after coagulation, and the same case seen a month later, demonstrating a lateral lobe projection, which requires further treatment.

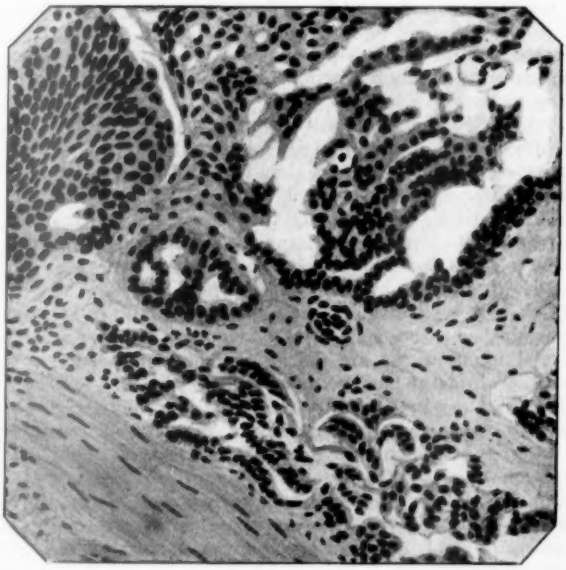
(i) That the results are slowly acquired, because time must elapse before tissue sloughs away. This is not strictly true; results often come early because the tissue treated is at once softened and disintegrated, and yields to the passage of urine. It is true that it may take a month or more before all the tissue is actually shed, as is easily proved on subsequent inspection.

(ii) Sepsis.—In my experience sepsis has been of a mild nature and has seldom given me cause for alarm. It usually amounts to little more than a "silent," symptomless pyuria and, occasionally, epididymitis. I have had no cases of ascending, or perivesical, sepsis. Hæmorrhage, either primary or secondary, has usually been of a very mild nature.

(2) The punch.—In 1928, 1929 and 1930 I made extensive trials of various punches, including one of my own design. I generally found that grasping of the required piece of gland was difficult and inaccurate. Primary and secondary hæmorrhage both occurred, and one patient died from indirect effects of the latter; he contracted pneumonia and empyema after an anæsthetic given in order to open his bladder for a hæmorrhage, fourteen days after the operation. I absolutely gave up

× 240.

FIG. 2.—Simple prostatic enlargement. Histological structure of resected portion of prostate, demonstrating the value of resection as an aid to diagnosis.



× 240.

FIG. 3.—Carcinoma of prostate. Histological structure of resected portion of prostate demonstrating the value of resection as an aid to diagnosis.

the punch after a series of experiments on the cadaver, which led me to realize how close to the ureters the scope of the punch could encroach, and I felt that if I did not damage the ureter directly, œdema and sepsis were factors liable to cause an ascending infection.

(3) Resection.—The technique of resection is by no means simple. There are so many things to go wrong, and not until I had performed the operation at least ten times did I feel a degree of confidence in my ability. Only those familiar with the cystoscope and urethroscope should venture the operation. I am fully convinced that it is wiser not to attempt too much at one sitting, and to be content with performing repeat operations, if necessary. Patients readily submit to this policy when the conditions of safety are explained to them. A striking fact is the shrinkage of the gland as a whole generally noted after even a comparatively limited first operation, which was, however, sufficient to allow of the easier voiding of urine and so, I take it, to diminish congestion. I have, so far, had only one case of alarming hæmorrhage, but the same type of sepsis as that to which I referred when speaking of electro-coagulation, including epididymitis, occurs.

In one of my early cases there was a much larger prostate than I reckon to come within the scope of per-urethral methods—a prostate which I should, in the ordinary course of events, have removed suprapubically, but the patient had a blood-urea of 60 mgm. per 100 c.c., a systolic pressure of over 200, and a history of bleeding readily on all occasions. His residual urine was ten ounces and he suffered from great frequency, often being disturbed every half-hour during the night. I removed a large mass of tissue, and I took an hour and a half to perform the operation, as I dealt with every bleeding point with the utmost care. There was no post-operative hæmorrhage, but the patient had true incontinence which lasted for nearly three months. I am glad to say that he has completely recovered from this and is now in excellent health, there being no residual urine. He is able to work in his shop from 8 a.m. to 8 p.m., and is seldom disturbed more than once during the night.

We now come to the two main considerations : (*a*) The type of obstruction suitable for per-urethral diathermy ; (*b*) the type of patient for whom per-urethral diathermy is especially indicated.

(*a*) *The type of obstruction.*—Upon this subject it is difficult to be dogmatic. We all know something of the anatomy and pathology of the bladder-neck subjected to the changes due to the enlarging prostate, but the physiology of the muscular activity remains obscure. How are we to regard the enlarged gland as interfering with the act of micturition? (i) Is it purely by the mechanical obstruction it causes? or (ii) should we regard defective micturition as due to sphincter deficiency, an inability of this muscle to relax to open the bladder-neck, called by Leguen "dysectasis of the vesical orifice," and alleged by him to be frequently associated with prostatic enlargements? When we consider that a patient from whom a prostate weighing over half a pound has been successfully removed by prostatectomy, can regain absolutely normal function, we are driven to believe that the mechanical, rather than the physiological, factor has the more important rôle.

I generally restrict my indication to that type in which I can see an enlargement which I believe to be causing an obstruction. The only obstructions I can see are those caused by bars and intravesical middle and lateral lobes. I can see *intra-urethral* lateral lobes, and I can measure the length of the prostatic urethra above the verumontanum, but I am unable to convince myself of the degree of obstruction these are causing, realizing the number of patients one sees with considerable extravesical prostates and no interference whatsoever with normal micturition. Thus, the obstructions which I think suitable are : (*a*) Intravesical projections, middle and lateral lobes, single or combined, with little, if any, extravesical enlargement. (*b*) The median bar. (*c*) Fibrotic prostates. (*d*) Post-prostatectomy

obstruction of a diaphragmatic type. (*e*) Carcinoma (some cases). (*f*) Extravesical enlargements, where permanent suprapubic drainage has been established, as a "try-on," where prostatectomy is permanently contra-indicated. The patient is no worse off if it fails, the general disturbance being minimal with an open bladder.

To ascertain the nature of the prostatic upgrowth.—At the preliminary cystoscopy, after the residual urine has been measured and the general state of the bladder noted, the existence and contour of the intravesical projection are observed. To me a difficulty exists in defining the exact size of intravesical lobes by mere cystoscopy or cysto-urethroscopic inspection. The height I can gauge with fair accuracy, but the thickness, in many cases, I can only ascertain with certainty by transfixion with my own type of electrode, noting the distance the shaft enters before the point appears on the vesical side of the gland. Such measurement is very important in deciding (1) if the case is suitable for per-urethral methods, and (2) whether one or multiple operations are likely to be indicated. Cystography may, in certain instances, throw light upon the nature of upward projection.

(*b*) *The type of patient.*—(1) The otherwise healthy bread-winner, who cannot afford to give up time to undergo prostatectomy. (2) Sufferers from cardio-vascular disease: (i) Defective myocardium; (ii) low blood-pressure; (iii) high blood-pressure; (iv) bleeders. (3) Sufferers from respiratory disease, chronic bronchitis, emphysema, bronchiectasis. (4) Nerve cases. A large group is here included: (i) Mental defectives, graded down from certified lunatics to the very nervous and fatuous—all are singularly ill-suited for prostatectomy. (ii) ? Nerve bladders. Often these are experimental treatments, for it may be difficult to ascertain if retention is due to the prostate or to neuro-muscular disturbance, possibly the first manifestation of tabes. I have had five such cases, all of which my medical colleagues and myself had rather thought were tabetic, but in all the treatment was successful, proving that the middle lobe projections, small though they were, were, after all, the cause of retention. (5) Fat, flabby, constipated patients with, perhaps, volvulus suspected or proved. Ileus is so probable in these cases as to make prostatectomy hazardous. (6) Cases in which renal function remains defective in spite of all the known methods of restoration. (7) Associated with other local lesions: (*a*) In the bladder: stones, suitable for litholapaxy, papilloma suitable for fulguration, or diverticulum. (*b*) In the abdomen: colostomy. Large ventral hernia.

My series includes examples of all these groups.

Time will not permit of my going into the technique, difficulties and dangers of the operation. All the preliminaries which are so well established for prostatectomy, should be carefully observed. Tests of renal function, adequate catheter or suprapubic drainage, and such other pre-operative preparation as the case may demand, should not be omitted. The operation, though minor in extent, may be major in its effects, the more so from the constitution of the individual likely to be subjected to it. Hæmorrhage must be checked before the patient leaves the table, and a catheter is tied in and retained for three days. A striking phenomenon is the absence of post-operative pain.

Personal case series.—Seventy-five cases have been carefully recorded and followed up. Of this number the average age was 64·7 years; twenty-one were over 70 years of age, one was 90, and one 84. Acute retention of urine had occurred in twenty-three cases, and retention with overflow in eight. Three had 60 oz. of residual urine, and one 50 oz. The series includes three cases of carcinoma.

Several cases were definitely uræmic when first seen by me, both clinically and according to renal function tests. One patient had a blood-urea of over 200, and had had acute retention with overflow incontinence. He is now a perfectly fit man, and able to work full time. I demonstrated this case at King's College Hospital to some of the members present here.

There are also three cases of post-prostatectomy obstruction.

Results.—There have been three post-operative deaths in the series. These were in patients who would certainly have died after an open operation. My experience tells me that a large percentage of the remainder would also have died; I should put the figure at well over 20%.

The results have been highly gratifying, and the readiness of the patients to attend follow-up investigations and to reply to questionnaire letters bears testimony to the pleasing outcome.

In fifteen cases suprapubic drainage was necessary before it was considered safe to touch the prostate. In the majority the patient's general condition had given so much anxiety as to indicate that nothing better could ever be offered. All the patients, except one, subsequently recovered, and are now passing their urine naturally and well. The exception was a definitely malignant case, in which the patient died two months after returning home.

Methods employed in seventy-five cases.—In 53 electro-coagulation alone; in 4 diathermy punch; in 3 electro-coagulation and diathermy punch; in 13 resection alone; in 2 electro-coagulation and resection.

Post-operative complications.—Except where I used a punch I have had little cause for anxiety. After electro-coagulation, in only two cases was there bleeding to any extent, and only in one after resection (on the fourteenth day). With neither method have I had to open the bladder for bleeding. When hæmorrhage occurred after resection it was necessary to evacuate clots with a Bigelow, under general anæsthesia, and to tie-in a catheter. The bleeding then immediately ceased, and there was no recurrence; septic complications followed this procedure, including pyelitis with rigors, severe cystitis and femoral thrombosis. This patient (still in hospital) is slowly recovering.

Incontinence.—A mild degree usually follows for a few days after resection. In one case it lasted nearly three months. All the patients have regained perfect control.

I have met with no other complications.

In two cases, amongst the earliest in my series, I carried out subsequent prostatectomy. They both occurred when my technique was immature, and my courage did not permit of my doing as much as I should have done. Both patients had large projections, and each was keen to be "put right once and for all." In both cases enucleation presented no difficulties and convalescence was normal.

Perhaps the most interesting case of all was that of a man who had a spontaneous rupture of the bladder from prostatic obstruction—the only one I have ever seen. For this he had been dealt with elsewhere by laparotomy and suprapubic drainage. He was transferred to me with all his urine escaping from a suprapubic tube. I found middle-lobe projection and a deeply sacculated bladder. Coagulation of the middle lobe was sufficient to put the patient completely to rights, and he subsequently left hospital healed and micturating normally.

Deaths.—Of the three already mentioned, the last was nearly two years ago (July 1931).

The fatal cases were:—

(1) A case of post-prostatectomy obstruction which dilatation, by bougies, failed to relieve for more than a day or two. The patient, aged 78, was partially uræmic and very irritable and intolerant. I had not performed the first operation in this case and I did not know the true nature of the prostate, but I am inclined to think it was malignant. For various reasons suprapubic drainage was undesirable. A diathermy punch was used, hæmorrhage was considerable, and the patient died the following day from uræmia and shock.

(2) Here the death took place after drainage of an empyema. This had followed post-operative pneumonia, after cystotomy, on account of a hæmorrhage which had occurred fourteen days after a punch operation.

(3) In this case colostomy had been performed for carcinoma of the rectum, producing acute intestinal obstruction. When I first saw the patient a catheter had been tied in for six

weeks, on account of acute retention following colotomy. There was acute cystitis and urethritis, and the patient was uræmic. Bladder drainage was obviously to be avoided with a colotomy opening situated so near, and so I risked per-urethral diathermy. Death from uræmia took place a few days later.

Bladder atony.—I have little doubt that the over-stretched atonic bladder is better rested and regains its tone more rapidly when drained by cystotomy than when drained in any other way. My experience in dealing endoscopically with those over-stretched bladders due to intravesical prostates, has taught me that tone is only slowly regained, and, until I realized this, I was rather disappointed with the unsatisfactory micturition in cases in which I was certain that I had removed the mechanical obstruction. In such cases I now regard post-operative catheterization as an essential part of the treatment. I have found that in some of these giant bladders catheterization may be necessary for as long as four months before the residual urine is brought to zero. Most of the patients are perfectly satisfied with their ability to pass urine long before this stage is reached, but the surgeon cannot be satisfied, especially as persistence of residual urine usually means persistence of bladder sepsis.

I am often asked if these per-urethral procedures are lasting in their good effects. I have quoted one case of over six-and-a-half-years' duration. I have others nearly as long.

I have noted as a curious fact that glands in the course of enlargement appear to obey some law as to the nature of enlargement, i.e., those which began to grow and progress intravesically remain of the same type and do not tend to develop, to any great extent, extravesically. This I have observed, not only in individual cases in which I have removed an intravesical projection by diathermy, but in patients not operated upon who have been living a catheter life, and been under my personal observation for a number of years. I have not had a single case of relapsing obstruction when per-urethral diathermy had adequately removed an intravesical obstruction, or in which such extravesical enlargement as could be detected on digital examination of the rectum has developed. Incidentally, too, no case has, to my knowledge, become carcinomatous.

It has appeared to me reasonable to expect of per-urethral methods little more than elimination of obstructions at or above the bladder-neck, any attempt to open up the prostatic urethra risking defeat of its objective by subsequent fibrous tissue formation. Guttering, now proved to be possible by resection, can to a certain extent increase the antero-posterior diameter of the prostatic urethra, but it is hardly sensible to suppose that such guttering can be permanent in the case of a soft adenomatous gland, unless the tissue in the immediate vicinity could be rendered firm and unyielding by formation of protective fibrosis. I shall be interested to learn if such has been the case in the experience of those who have made a practice of resecting extravesical, soft adenomatous glands. Perhaps we may, in time, learn how to procure a laudable sclerosis in these glands by deeper electro-coagulation by transfixion diathermy. We know the rarity of adenomatous enlargement in old inflammatory (gonorrhœal) prostates and we suppose this state to be due to fibrous tissue preventing glandular expansion. Could such a pathological benefit be produced by artificial means in this way? My own experiments have not so far carried me to this investigation, but I am inclined to think there is a possible future in this respect.

A study of the longer series of cases treated by the various methods of per-urethral diathermy necessitates examination of publications, for the most part by American authorities. To analyse and criticize the figures is difficult, and to base an opinion upon the relative merits of each method is more so, since many conflicting points must emerge. Are we, first of all, to regard the punch method of Caulk as the safest, because he has treated 800 cases in this way with a mortality of about 0·7%? A significant fact is that in his recent writings he advocates multiple small

operations, perhaps as many as five; of his last 134 cases, in 60% two operations were necessary, in 40% more than two.

Resection.—Regarding resection, the latest publications of the chief protagonists indicate a tone of less assurance than formerly, and a critical survey of the figures from a number of American clinics by Bransford-Lewis and Grayson-Carroll, published in January of this year, sounds almost a dismal note. Thus, from one clinic a mortality of 22% in the first forty-one cases is noted, from another 24% in the first fifty cases. At another clinic prostatectomy had to be performed in seven out of twenty-seven cases treated by resection. Reference is made to the high percentage of primary and recurrent hæmorrhage, to cases of severe infection, perforation of the bladder, recto-vesical fistula, and failure to relieve urinary obstruction. Both Stern and Davis issue cautionary advice and it is not without significance that whereas, in Davis's clinic, in 1930 sixty, and in 1931, 158 resections were carried out, in 1932 there were only forty-seven. Collings, in his address to this Section last year,[1] gave large numbers of cases treated by his method, but since the average age of the patients appeared to be in the neighbourhood of 54 it is obvious that he was dealing with a different type of case from that of our conception, and his figures, therefore, may be ruled out.

To attempt to assess the merits of each method according to statistics, is therefore, liable to lead to confusion, and will not carry us far in the selection of a method for ourselves. The natural tendency with each new method has been to overdo it; the outcome of new operations is seldom quite up to expectations.

That per-urethral diathermy methods, with emphasis upon electro-coagulation and resection, have their place and have come to stay, I do not doubt, but much common sense and repression must be exercised lest we allow ourselves to be carried away by the whirl of the tide.

The operation of prostatectomy remains upon a firm basis, and I would not say that it is even challenged, to any great extent, by these modern methods. I am not one of those who believe in the obsolescence of prostatectomy.

Mr. T. E. Hammond: In a paper published in 1926, based upon twenty cases, I pointed out that the diathermy punch was of value in certain types of cases in which the operation of prostatectomy did not give satisfactory results, namely, cases with the prostatic bar, the small fibrous prostate, or the large fibrous prostate which was as a rule secondary to an old inflammation.

Here the obstruction was limited to the bladder-neck and was not progressive. This method failed when the middle lobe alone was enlarged, as it was impossible to fix it in the opening to punch it out. It also failed when the lateral lobes were enlarged, because here the obstruction was throughout the urethra and was progressive. With cancer relief was temporary and the disease seemed to go ahead more rapidly. Fourteen more cases were operated on by this method up to 1931.

A cystostomy was carried out at the same time in ten cases, owing to the presence of some infection or to signs of renal failure. There were two deaths in the 34 cases and in one case cancer developed within a year. There were two cases of secondary hæmorrhage one of which ended fatally. The results on the whole were good, but in ten cases there was still some residual urine and it was necessary to pass a bougie at intervals. The results on the whole were not so good as after prostatectomy, but they were certainly better than those that followed prostatectomy in this type of case. As the punching had to be done blindly, it was impossible to be certain that the whole of the obstructing mass was removed. Cases of the small irritable prostate or the inflamed prostate in which there was no real obstruction are excluded from the above; these improve with medical diathermy.

The introduction of the endothermy current allows a clean cut to be made under water, and the operator is able to see what is being done in the region of the neck of

[1] *Proceedings*, 1932, xxv, 269 (Sect Urol., 1)

the bladder. This is a great advantage as it is now possible to treat the obstruction more effectively. In addition to the type of case previously treated, it is now possible to deal with post-prostatic obstruction, and bigger enlargements of the middle lobe. Since 1931 sixteen patients have been treated by this method. Ten had obstruction limited to the neck of the bladder, two were due to enlargement of the middle lobe, and four were cases where the lateral lobes were enlarged but there was a definite contra-indication to prostatectomy owing to some heart or lung affection. The improvement in the first twelve is certainly better than after blind punching. There has been an improvement in the last four, as the symptoms have become less severe and the residual urine has diminished. These cases have, however, been observed for less than two years and it is not yet certain what the end-results are going to be. This applies to all the work that is being done in this direction; for before 1931 no attempt was made to deal with the enlarged prostate in which the lateral lobes were enlarged. And two years is too short a period to be certain of its application in this type of case.

All these cases were dilated up to a 30 Charrière bougie, and the catheter that was retained for five days was 26 Charrière. It is possible that some of the improvement may be due to this, for it was regarded as a method of treating the enlarged prostate at the beginning of this century and had some temporary success. It was only as the years went by and the cases relapsed that it was abandoned.

The possibility of some of the improvement being due to the natural course of the disease is rarely taken into account. It is assumed that because a pathological condition is present, the sequelæ are certain to occur unless treatment is carried out, but it has always been admitted that in 66% of cases of enlarged prostates, symptoms need never arise, though when symptoms appear, they are generally progressive. But it is not meant that this need take place in a couple of months, for it is more likely to be a matter of years. When deciding as to whether an operation is indicated in a man with a few prostatic symptoms and a little residual urine at, say, the age of 65, the surgeon is not concerned with what might take place by the age of 67, for two years is a small period in the life history of the prostate. He is considering whether, if no operation is done, gradual back-pressure upon the kidneys may not develop and the symptoms may not become sufficiently severe to demand operation at a time when the patient is less fit to stand it, say at the age of 70 or 75.

Even when severe symptoms arise, it is not infrequent to find that they may clear up for many years as the following case which was seen by me recently, shows:—

A. E. had an attack of retention at the age of 70, which cleared up after the passage of a catheter on two occasions. He had no symptoms but had another attack of retention at the age of 76 which cleared up after the passage of a catheter. He had no further symptoms until he was 87, when retention again supervened. This was also overcome by the passage of a catheter on one occasion. Now had X-rays, or radium or trans-urethral resection been applied in this case, it would have been regarded as a cure, particularly if the patient had died at the age of 75.

A period of two years is far too short to observe the effect of treatment upon the enlarged prostate, and improvements that are really part of the natural course are often attributed to it.

Whilst it is possible to remove the whole of the obstructing mass at the bladder-neck and to be fairly certain, at any stage, of how much has been taken away, since the ureteral orifice can be used as a landmark, this does not apply once the prostatic urethra has been entered. For though the first resection is known to be a quarter of an inch deep, once the mucous membrane has been destroyed, the only landmark has gone, and from then it is impossible to know how deeply the prostate is being penetrated. Nor do many who advocate this method of treatment now claim to

remove the lateral lobes. At first diagrams were given showing the large amount of prostatic tissue that could be taken away. To-day it is said that removal of the lateral lobe is unnecessary, and that if the posterior commissural hypertrophy is removed all residual urine disappears and there is no longer any possibility of retention. As a result of this the lateral lobes will shrink. Now this is the first time that it has been suggested that the residual urine is the cause of the prostatic enlargement and to justify this line of treatment our views upon the pathology are being changed. It is not infrequent to come across cases in which there is a large amount of residual urine and in which the lateral lobes are alone enlarged. When a prostate has been enucleated and a lateral lobe left, it is known that symptoms will persist until this is removed. Whilst some improvement does follow this method, it is too early yet to know whether it will be permanent. At least five years must pass before conclusions can be reached. Consequently it is impossible to compare it with prostatectomy from the point of view of mortality and the suffering incidental to the operation. For this is a most successful operation as a result of which the patient remains free from symptoms not merely for a couple of years but for the rest of his life; it is certain that back pressure and retention will not supervene. We cannot yet say this of per-urethral treatment when the lateral lobes are enlarged.

The conclusions I have reached are as follows:—

(1) Where the obstruction is at the bladder-neck, trans-urethral resection is far preferable to prostatectomy. Cases have been observed over a sufficient number of years which prove that the results are permanent. The modern resectoscope allows the obstruction to be completely removed.

(2) The treatment of the enlarged prostate by resection is still in its experimental stage. It is too early to know whether the improvement is permanent. There is less shock, the stay in bed is not so long, and the risk is not so great. But these may be more than counterbalanced by having to repeat the procedure at a later date. For the present it should be confined to cases where some contra-indication to prostatectomy exists.

(3) The operation of prostatectomy is still the operation of choice for the simple enlargement, for by it alone are we certain that the patient will be free from back pressure upon the kidneys and that he will not be afflicted by troublesome urinary symptoms towards the end of his life.

Mr. E. W. Riches: My remarks will be confined to my experiences of endoscopic resection with the McCarthy type of electrotome. Cutting diathermy has at least theoretical advantages over electro-coagulation, whether followed by a punch or not, and whilst I am sure that the latter operation can give admirable results—for I have been privileged to see some of Mr. Everidge's cases of several years' standing—I feel that it is now superseded by the cutting operation, except perhaps for a small particular group of cases. Whether the telescope moves with the loop or not is a matter of individual taste; the important thing is to become accustomed to one instrument. The large size of the 28 Charrière tube is sometimes a disadvantage. I have had to perform a meatotomy in one case in order to introduce the endoscope, and in one or two others there has been sufficient meatal stenosis produced to demand intermittent dilatation afterwards. The 24 Charrière instrument is not very satisfactory as the pieces removed are so small; perhaps a 26 Charrière tube will be found the most generally useful.

I am not going into operative details, which have been already adequately described, except to say that I avoid the use of coagulation to stop bleeding if at all possible, as I believe that it causes post-operative pain. Hæmorrhage, whether primary or secondary, has not been great in my experience. The crux of the

problem appears to lie in the proper selection of cases, and it is to this that I propose to devote my attention.

Before deciding to try any new method of treatment for enlargement of the prostate we must consider what advantages it appears to promise over existing methods with regard to the quality and permanence of results, risk of mortality, and duration and comfort of convalescence. Suprapubic prostatectomy is now sufficiently well established to enable us to assess its good and bad points under these headings; the per-urethral operation has not yet for all of us emerged from the period of trial.

Recent analysis of a seven-year series of suprapubic prostatectomies at Middlesex Hospital has shown that in cases of non-malignant prostatic obstruction the results depend to some extent on the histological structure of the prostate. Thus in the glandular type, where the material removed consists of glandular tissue in its normal stroma, the results are good in about 90% of the cases. That they are permanent is shown by the extreme rarity of the necessity for a second prostatectomy, although it may be noted that it is the rule for the prostate to reappear in this type. The mortality in this series was 10% for glandular prostates; the incidence of post-operative inflammatory complications was 16%. The period in hospital is usually about a month, but the immediate post-operative convalescence can hardly be called comfortable. With an increase in the amount of fibrous tissue in the prostate, either in the stroma or by fibrous replacement of the glandular nodules, which change is probably largely the result of infective processes, the results deteriorate in quality, although the benefits are still permanent. The immediate mortality rises, and the incidence of post-operative inflammatory complications, with attendant increased discomfort and prolonged convalescence, is greater. Finally, in calculous prostatitis, where the picture is one of chronic inflammatory changes in an atrophic gland, the results are still less good, the mortality is higher, and the post-operative complications considerably increased. It is therefore not unnatural to try this newer method of treatment primarily for those cases in which, from local reasons, we know the results of suprapubic prostatectomy to be less certain and the risks greater, that is to say, for the fibrous type of prostate, for calculous prostatitis and for carcinoma.

Clinically, the main distinguishing feature of the fibrous type is its relatively small size in comparison with the glandular type, but when put to the test of the microscope after removal, only about 6% of the prostates removed prove to be true fibrous prostates, that is to say those in which the glandular elements are almost entirely replaced by fibrous tissue and fibrous nodules are present. I have only found these fibrous nodules on section in two cases treated by endoscopic resection. Nevertheless, the process of fibrosis is gradual and about 28% of prostates removed can be classed as intermediate between the glandular and the true fibrous prostates.

The other type of non-malignant prostatic obstruction which is known to be troublesome for suprapubic removal is that due to calculous prostatitis. In our series at Middlesex it accounted for only 8% of the total, but these carried a mortality of 22%. 66% of them had post-operative inflammatory complications and in only 43% could the result be classified as good. I therefore welcomed the opportunity of treating such a case by the per-urethral method, and would like to give a brief account of it.

A man, aged 54, came to hospital with retention of urine. For five years there had been difficulty in micturition necessitating the occasional use of a catheter, and for a few days he had been passing painfully only small amounts of blood-stained urine. He was vomiting and uræmic, and his blood-urea was 101. The crepitus of calculi could be felt in the enlarged prostate and the urine was heavily infected. Drainage was carried out through an indwelling catheter for ten days, by which time the blood-urea had fallen to 40 and the urea

concentration was normal. I then performed an endoscopic resection, removing only 2 grm. of tissue and feeling the loop jump calculi from time to time.

Histologically the structure was that of a typical calculous prostatitis, with atrophy of some acini, epithelial hyperplasia of others, and much chronic inflammatory infiltration. During the following three weeks he passed several stones, up to ½ in. in length, and within a month he was passing water without pain or difficulty and there was less than half an ounce of residual urine.

Later I tried the same method on another similar case but was quite unable to remove any tissue at all, the loop striking stone at each attempt. I feel that this is possibly one of the few cases in which coagulation by a spear electrode might be of use, but I should be rather fearful of infection. Resection by the cutting loop may or may not be possible.

In carcinoma of the prostate per-urethral treatment has proved of considerable value. By no means all cases of carcinoma have symptoms of prostatic obstruction, but in those which have, it is possible to resect a sufficient amount of the obstructing tissue to restore the normal urinary function, provided the urethral lumen is large enough to allow the instrument to be introduced. Even in a case with extensive bony metastases it is possible to restore the patient to urinary comfort. That the patient may live long enough to require a second resection is an added reason for performing the operation. In one case of unsuspected carcinoma, proved to be malignant on microscopy, I performed a subsequent suprapubic prostatectomy followed by deep X-ray treatment, feeling that this would give the patient a better chance of prolonged freedom from the disease.

That is one method of selection of cases which may be termed the method of "local exclusion," those cases being treated per-urethrally which are relatively unsuited for suprapubic removal. It is obviously not the fairest one if we are trying to make out a case for the newer operation. In fact, experience shows that for per-urethral, as for suprapubic, prostatectomy the convalescence is smoother and the results are better in the case of a glandular enlargement than in that of a fibrous prostate, but for the fibrous prostates alone the balance of evidence is in my opinion in favour of the per-urethral method rather than suprapubic removal.

Another method of selection of cases has, I fear, been to use the per-urethral method for those cases which are considered on general grounds to be too poor risks for suprapubic removal, even after preliminary drainage. This may be termed the method of "general exclusion." This again is obviously an unfair method if it is to be applied as a test of the value of per-urethral treatment, and again experience shows that these are just the cases in which disaster may overtake us. It was my hope in beginning to use the per-urethral method that it would solve the problem of the poor-risk case in a better way than permanent suprapubic drainage or a catheter life. It is too early to say that it fails to do this, but there is sufficient evidence to show that it carries a considerable risk and mortality in this type of case. On the whole I consider the risk of per-urethral treatment, even after preliminary drainage and adequate pre-operative treatment, to be only slightly less than that of suprapubic prostatectomy in the really poor-risk case. A physician having visited a ward full of prostatic patients stated that he thought most of them would stand a shave and a hair-cut if it were done in two stages! Unfortunately there are many such patients applying for treatment and their problem is not yet solved. The greatest danger for them is uræmia, their kidneys being already damaged by long-standing urinary obstruction. When infection is added to this the risk is extreme. If I appear to be unduly pessimistic it is because I feel that much has been written in praise of per-urethral treatment which is calculated to give the impression that it is a minor procedure devoid of risk. It is so in cases without renal damage or infection, but either of these frequent complications renders it hazardous. As an example I would quote the case of a man aged 88 who had led a catheter life for two years, but

in whom there was recent difficulty in introducing the catheter. He had a large glandular prostate with fourteen ounces of residual infected urine; blood-urea was 57. I carried out drainage by suprapubic de Pezzer catheter for six weeks, by which time the blood-urea had come down to 43. The patient was very anxious to have the suprapubic wound closed, and I did a resection under low spinal anæsthesia. He appeared to stand the operation well, but fourteen hours later he went into coma and died nineteen hours after operation.

The third method of selection of cases, and I think the right one, is on the merits of the operation alone as shown by experience in its use. In the early stages of prostatic enlargement, before the prostate has had time either to become enormous or to undergo fibrous change, but when it is giving rise to symptoms, it can be dealt with effectively and with a minimum of risk and discomfort, by resection. The patient is out of hospital within a week or ten days and within a short time is conscious of the increased force of his stream, the absence of pain and of delay and difficulty in starting, and of a night's rest undisturbed by frequent calls to micturate. This procedure has been decried as being a return to the unsatisfactory days of partial prostatectomy as practised by McGill. But in endoscopic resection the removal includes not only the intravesical projection but also a wedge of the middle and lateral lobes as far down as the verumontanum. I cannot believe that it is a retrograde step, but I feel that it is a stride forward in preventive surgery. Just as we treat a urethral stricture before acute retention supervenes, so should we treat prostatic obstruction before the possibility of uræmia and infection make any form of treatment hazardous. Time alone will show whether a second resection will become necessary, but again I would state that even after suprapubic prostatectomy for glandular enlargement the reappearance of the prostate is the rule. A patient who is sufficiently sensible to come for treatment when he first has symptoms will be spared the risk and discomfort of a prostatectomy.

The recognition of the bad-risk cases depends on the clinical picture and on urinary and renal function examinations. Of the renal function tests I consider an isolated blood urea estimation useless and even sometimes misleading. The urea-concentration test is rather more reliable, but I believe the urea clearance test of Van Slyke and excretion urography to be the most useful tests we have at present. I will not perform a resection now unless the urea-clearance test shows at least 50% renal function; I would prefer 60%, and in a doubtful case would have an excretion urogram to gain some idea of the degree of dilatation of the renal pelves. I believe there are many cases in which no preliminary treatment will render the patient fit to undergo resection, and these patients are condemned to permanent suprapubic cystotomy. Drainage alone, whether by indwelling catheter or by a suprapubic tube, is likely to be of greater value in the treatment of renal inefficiency than of sepsis; in a non-infected case it introduces the danger of infection and may make the risk of resection greater. I have since learned that this conclusion has also been reached at the Mayo Clinic.

If the greatest use is to be made of the operation, I feel that it should be used on its merits and not be regarded as a method of treating cases which are too bad for prostatectomy. It gives excellent immediate results in cases of relatively early glandular enlargement, in carcinoma, and in some cases of fibrous prostate and calculous prostatitis. The main problems that confront us are in finding better methods of improving renal function after preliminary drainage, and in educating patients to come for treatment in the early stages of their complaint.

Mr. W. K. Irwin: In the course of this discussion it has been said that prostatectomy is not a satisfactory operation. I am convinced that a skilful surgeon, if he ensures proper pre- and post-operative treatment of the patient, can make it a most satisfactory procedure. Why should we abandon such an operation which is

complete and curative, and adopt per-urethral diathermy treatment, which is manifestly incomplete and often only palliative? Statistics prove that the advocates of the latter method cannot claim a lower mortality as a reason for their enthusiasm.

Per-urethral treatment is wrong on principle. What would any of us think of a laryngologist who treated a patient for enlarged tonsils by scooping or nibbling a piece from the surface of each gland? Yet, in my opinion, such a person would be on less dangerous ground than the urologist who used per-urethral diathermy methods for treating prostatic enlargement: the former would be leaving behind tonsillar tissue which might provide a focus of infection, whereas the latter would be leaving behind prostatic tissue which might prove a source of infection, malignancy, difficult micturition, or retention of urine.

The prostatic region is one of the great distributing centres of sepsis, and that is one of the many reasons why I advocate prostatectomy in preference to per-urethral methods of treatment, which are against all the principles of surgical pathology.

Mr. Clifford Morson said that he also would emphasize the grave danger of sepsis in per-urethral treatment of the enlarged prostate. In his opinion sepsis was a more serious complication of per-urethral treatment than when it occurred in prostatectomy. A case treated by the per-urethral method had come under his observation in one of the L.C.C. hospitals. The patient was passing his urine every five minutes and complained of pain on defæcation. Cystotomy revealed sloughing of the tissues of the bladder-base and prostatic bed. A small recto-vesical fistula was present. In spite of bladder drainage, death occurred from sepsis.

Mr. H. P. Winsbury-White: I too, feel that sepsis is a condition of outstanding importance in treatment by this method. With the most recent type of cutting instrument large masses of tissue can easily be removed from the neck of the bladder. In doing so without performing suprapubic cystotomy we are violating an old-established principle of bladder surgery, whereby cutting operations within the vesical cavity should be accompanied by suprapubic drainage. If we disregard this principle, we must not be surprised if a certain number of our cases go wrong. Small wonder is it that infection should be stirred up by this procedure when we recall the fact that the enlarged prostate is so frequently the seat of a superimposed infection.

Let no one regard trans-urethral resection of prostatic tissue as a minor operation. The procedure can be followed by all of those complications which we see from time to time after prostatectomy. I have, personally, lost one case from pulmonary embolus. On the other hand it is very gratifying to note how undisturbed the convalescence can be if the trans-urethral resection is preceded or accompanied by a suprapubic cystostomy. I have operated on a number of cases of prostatic enlargement in this way and have not had cause for any anxiety in the convalescence of a single case.

It is instructive to observe the state of the urine following resection when suprapubic bladder drainage has not been instituted. It is loaded with pus and débris for weeks following the operation and I cannot help feeling that the patient is extremely fortunate if no serious infective complication supervenes.

One fact especially seems to me to supply a constant source of danger in cases in which there is much residual urine, and in which suprapubic drainage is not provided. That is when, in spite of removal of a lot of obstructing tissue, residual urine still remains after the operation. In spite of the greatest care this sequel is frequently present. In these circumstances any patient who escapes serious infective complications is fortunate indeed.

Nothing would induce me to apply the procedure to a patient who manifested signs of a uræmic condition. I would prefer to deal with such a patient in the first

instance by establishing indwelling catheter drainage, and only when I was satisfied that steady progress had been made would I consider it safe to undertake any cutting procedure.

It will be a great pity if this operation is brought into disrepute by its unsurgical application.

Mr. Clifford Morson has spoken of some of the bad after-effects with which he has come in contact in the municipal hospitals. This experience should be a warning to us that the immediate effects of operation may seem to be successful, whereas the ultimate result may be bad, but I cannot help repeating that I have found the procedure a thoroughly sound and satisfactory one when conducted in the proper way.

Mr. Morton Whitby said that he would endorse Mr. Irwin's remarks on the analogy with tonsillectomy. There was no doubt that anything short of enucleation for follicular recurring tonsillitis would be adjudged as bad surgery, as by any other operation (whether the guillotine or diathermy) septic foci would be left behind to cause a chronic toxæmia with occasional acute exacerbations, and apart from the possibility of re-growth of the tonsil.

The prostate in nearly all its pathological conditions was a septic body, and to temporize by per-urethral operations was asking for trouble. In dealing with the disease we must treat the cause. Prostatic symptoms were due to a pathological prostate producing obstruction. The only satisfactory way to deal with such obstruction was by enucleation through the suprapubic or perineal route. Until there was convincing proof that the entire prostate could be removed by the per-urethral operation so that no septic foci were left, he would regard it as a bad operation and against the practical principles of surgery. In his opinion, the only use the method had at the moment was by the punch, in cases of prostatic bar, but this was not a very frequent condition. The fibrosed prostate might be treated in a similar way, but he had never seen a case which could not be treated by the suprapubic method, although that method might call for a little extra energy.

Our aim in prostatectomy should be, as Sir John Thomson-Walker had suggested in his presidential address, to discover some means by which complete closure of the bladder could be effected by the suprapubic operation, with absolute safety to the patient, less dreaded post-operative treatment, shorter convalescence, and assured after-success.

Section of Ophthalmology.

President—A. C. HUDSON, F.R.C.S.

[*June* 9, 1933.]

A Case of Tar Epithelioma of the Lid Margin with Pathological Report.—By CHARLES B. GOULDEN, F.R.C.S., and H. B. STALLARD, F.R.C.S.

I.—Mr. C. B. GOULDEN (*Clinical Report*).

This case is apparently one of considerable rarity and I have been unable to find a reference to a similar one. A number of small tumours occur at the lid margin and if I had not been guided by the case history I should not have recognized the condition. It will remind members that such a tumour may occur so that they may be on their guard if a similar case comes under their notice.

The patient is a man, aged 33, a tar and pitch worker.

Past history.—On June 1, 1926, he came to the Dermatological Department at the London Hospital with a small pigmented wart at the right angle of the mouth and another upon the left side of the upper lip. On June 5 unfiltered radium was applied for two hours. On July 5 the radium was re-applied to the left upper lip for two hours. On August 24 the patient was reported as cured. On November 3, 1927, he again came to the Department with a wart on the left cheek. Applications of unfiltered radium were made for two hours on November 5 and again on February 14, 1928. On March 28, 1928, radium was applied to this growth upon the left cheek. It was also noted that there was a rapidly growing warty tumour in the region of the left inner angle of the orbit, which was curetted and to which radium was applied for two hours.

On April 27, 1933, the patient was referred to me by Dr. W. J. O'Donovan, under whose care he had been since 1928 for the various warts mentioned. These had entirely disappeared after radium applications and had not in any instance recurred. He was sent to me because thirteen days previously he had noticed a small swelling

on the margin of the left upper eyelid. This had gradually increased in size, without pain and with only occasional itching.

On examination a small spherical tumour about 3 millimetres in diameter was found on the margin of the left upper eyelid at the junction of the outer quarter with the middle three-quarters of the lid. It had a broad base and involved the anterior two-thirds of the lid-margin, leaving the posterior edge unaffected. It had smooth

outer walls which enclosed a small pigmented centre protruding a little above the general surface. The lymphatic gland in front of the ear was not enlarged. The tumour was removed by passing a keratome through the sharp posterior edge of the lid in an upward direction, and the small area thus isolated was removed with scissors by a wedge-shaped incision which involved the lash-bearing area of the lid and the skin of the lid. The wound was closed with silk sutures.

II.—Mr. H. B. STALLARD (*Pathological Report*).

The neoplasm was a squamous-celled carcinoma. Its surface was covered by a thick plaque of kerato-hyaline. There was evidence of hyperplasia and irregularity of the "prickle-cells" and "cell nests." At the advancing edge of the neoplasm in the corium there was considerable lymphocytic infiltration. The line of excision had passed wide of the malignant cells.

Comment.—Tar-carcinoma can be produced in experimental animals in from 55 to 360 days and attempts to isolate the ingredients, which are believed to possess a specific activity in the production of this disease, have so far been negative. These substances exist in very small quantities below 450° C. and appear in much larger amounts at 500° C. increasing at a slower rate up to 1,250° C. The histological changes observed in experimental animals are divided into three stages: (1) Hypertrophy and hyperplasia of an orderly type, and keratosis of the superficial layers; there is an increase in the elastic tissue of the corium, mast cells and lymphocytes. (2) Some irregularity of epithelial cells and keratosis in cells in the deeper layers of the epidermis. (3) Keratosis, mitotic figures, hyperchromatic nuclei, loss of elastic tissue and invasion of the corium.

An Operation for the Relief of Congenital Ptosis.

By R. AFFLECK GREEVES, F.R.C.S.

Cases of congenital ptosis may be conveniently divided, clinically, into three classes:—(1) Partial ptosis with fair independent levator action. (2) Complete ptosis with little or no levator action but with good upward movement of the globe. (3) Complete ptosis with deficient upward movement of the globe.

In order to estimate the amount of levator action present in any given case it is necessary to place one's hand firmly over the frontalis muscle while the patient makes an attempt to open the eye.

With the first and third classes I am not now concerned, except to say that as regards the first class, in my experience the best operation is to shorten the levator tendon, approaching it either by a skin or conjunctival incision (I, personally, prefer the latter). The third class I believe to be extremely rare. In most cases of ptosis a certain disinclination to turn the eyeball upwards is present, probably because this movement is never practised. The best method of determining whether upward movement of the globe is present or not is to bend the patient's head forward while raising the eyelids with the finger and to ask the patient to look at an object immediately in front. If this is done it will be found in nearly all cases that the eyeballs will be raised. Reports of anatomical investigations in ptosis cases confirm my view that the superior rectus is rarely absent. If, however, a case should present itself in which no upward movement of the globe could be elicited, the only possible means of relieving the condition would be, of course, by some form of plastic operation.

My chief concern in this paper is with the second class—which I believe to be much the commonest—namely, those cases with little or no levator action but a good upward movement of the eye.

The results of plastic operations are, in my experience, on the whole, disappointing both cosmetically and functionally, and Motais' idea of making the

superior rectus muscle take on the function of raising the lid, in addition to its normal one of raising the eye, has always impressed me as being a good one. In ordinary circumstances the upper eyelid and globe move upwards and downwards in conjunction, therefore, theoretically, the result of the operation should be satisfactory both physiologically and cosmetically.

Motais' operation consists in taking a slip of the superior rectus tendon and attaching it to the centre of the upper eyelid. I have performed a good many Motais operations and have been fairly satisfied with the results on the whole, but have found that disappointments not uncommonly occur, chiefly owing to the liability of the suture which holds the slip of tendon to the eyelid, to give way within a few days; when that happens the lid slips back and the ptosis remains unrelieved. Again, the fact that the lid is held in one place only often gives rise to a rather peaked appearance of the eyelid, associated with an ugly dimpling of the skin of the lid at the site of the attachment of the slip of tendon. Again, unless the attachment of the slip is exactly central, the lid is raised more on one side than on the other.

It therefore occurred to me that a better result might be gained by attaching the lid to the superior rectus muscle, instead of the converse, and with this end in view I devised the following operation which may be performed under general or local anæsthesia; with the latter, however, a certain amount of pain caused by pulling on the superior rectus tendon is inevitable. The eyelashes should not be cut.

A controlling suture is first inserted in the conjunctiva, immediately above the cornea, and the eye depressed as far as possible by its means. The superior rectus tendon and its attachment to the globe are then exposed by a horizontal incision through the conjunctiva and a squint hook is passed under the tendon (fig. 1, p. 70); a silk thread is then pushed under the tendon and the hook withdrawn, the two ends of the thread being secured by Spencer-Wells forceps. This thread is now used to control the eye in place of the preliminary conjunctival suture, which may be removed.

Next the upper lid is everted and the conjunctiva above the incision seized by forceps and dissected upwards until the upper edge of the tarsal plate is exposed. In detaching the thin conjunctiva from the tarsus, some button-holing is apt to occur, but this is of no consequence.

The upper edge of the tarsal plate appears as a convex rounded border; this is gripped centrally by catch-forceps on each side of which a thin strip of tarsus is cut with a fine pair of bent scissors, from without inwards and within outwards respectively, each strip being left attached centrally, the width of the uncut area of tarsal plate between the strips being about the same as that of the superior rectus tendon: as long a strip of tarsal tissue as possible should be aimed at (fig. 2). Sinclair's scissors, which he uses for cutting the cornea when extracting cataracts intracapsularly, are very suitable for cutting the strips. A No. 4 needle, threaded with No. 1 silk, is then passed through the end of one of the strips and again through the corresponding edge of the superior rectus tendon, a similar suture being passed through the other strip and the other edge of the tendon. The sutures are drawn tight without being tied, in order that a judgment may be made of the relative positions of the eye and eyelid; the position of the edge of the lid should be such that it slightly overlaps the upper part of the cornea. If the position of the lid is judged not to be correct, those parts of the sutures which have been passed through the tendon should be withdrawn and re-inserted in the tendon in a suitable position, either higher up or lower down as required. This part of the operation requires care and judgment, especially as the final position of the lid remains permanently unaltered, and this fact is one of the most satisfactory features of the operation. I have never found that the sutures gave way or that the lid altered its position in the slightest degree at any time after the operation It is not necessary to insert conjunctival sutures (fig. 3).

With regard to after-treatment, great care must be taken to prevent exposure of the cornea during the healing stage. It is better not to sew the lids together, the best form of dressing being a sausage-shaped pad placed over the upper lid, kept in place by strapping and a bandage; this prevents inversion of the upper lashes and

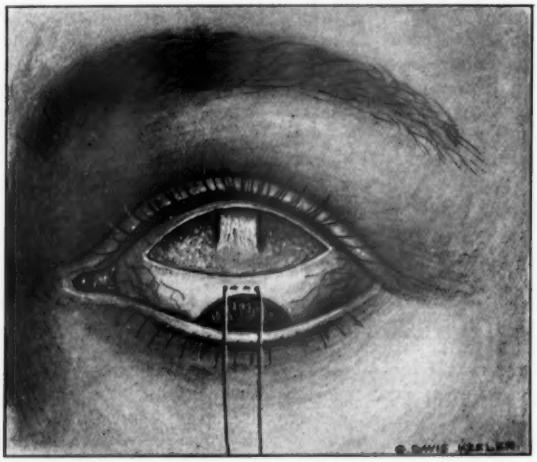
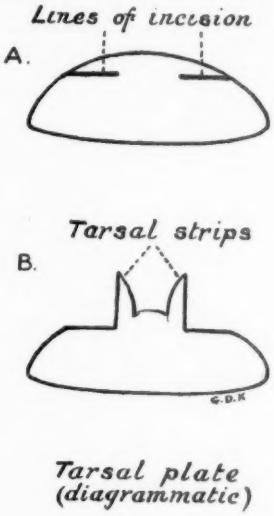


FIG. 1.—Showing the controlling suture, and the exposed superior rectus tendon.



Tarsal plate
(diagrammatic)

FIG. 2.

keeps the eye efficiently closed. The sutures can easily be removed in about ten days' time.

After healing has taken place and all reaction disappeared it will frequently be found that when the eyelid is raised, the skin of the upper lid is apt to fall in an

unsightly fold over the lashes; the skin is flabby and does not seem to possess a normal tone. This can easily be remedied by a plastic operation carried out on the principles of the Hotz operation. A horizontal strip of skin of suitable width is removed from the upper lid, the position of the lower skin incision corresponding roughly to that of the upper edge of the tarsal plate. The sutures which join the edges of the skin incision are carried through the deep tissues in such a way as to stretch the skin over the tarsus and to produce a fold in the skin of the eyelid in the normal position. This little operation can readily be done under a local anæsthetic.

Some years ago, George Young described an operation which consisted in stitching the tarsus to the sclerotic. It was, however, found by some operators who tried it that the desired junction between tarsus and sclerotic was apt to fail to establish itself. I have performed five operations according to the method which I have just described and in each case a firm junction between the tarsal strips and the superior rectus tendon has taken place.

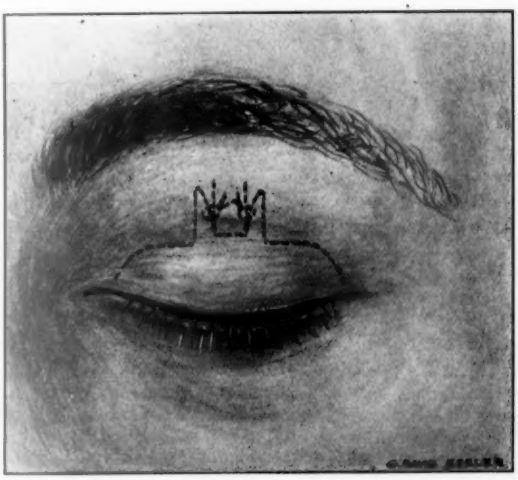


FIG. 3.—The dotted lines indicate the position of the tarsal plate, tarsal strips, superior rectus tendon, and sutures, when the operation is completed.

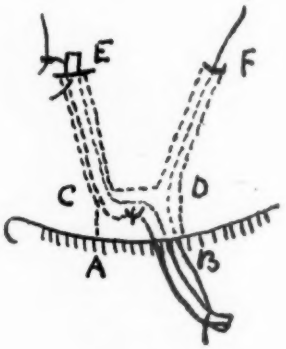
A decided advantage is gained firstly, by using strips of tarsus as the lid attachment, and secondly, by joining these strips to the sides of the tendon of the superior rectus.

An objection which has been raised to the type of operation in general in which the superior rectus is made to perform two functions (including of course both Motais' operation and that just described), is that in cases of unilateral ptosis when the one eye is not amblyopic, vertical diplopia is apt to result, owing, of course, to the extra weight thrown upon the muscle of the affected side. This statement is undoubtedly true, but the diplopia may disappear in time and even if it should persist, as far as the patients are concerned, I have not found that they are greatly incommoded. The eyes are, as a rule, straight in the primary position; it is only on looking up that the one lags behind the other, and while an upward movement of the eyes beyond the horizontal meridian is, of all the ocular movements, that least frequently performed by normal patients in daily life, the ptosis patient who has never been accustomed to raising the eyes before the operation, simply avoids doing so

afterwards. He is more than content if he can look straight in front without wrinkling his brows and throwing back his head and I claim that this result can in most cases be depended upon if the operation which I have described be carried out.

Discussion.—Mr. O. GAYER MORGAN said he did not agree that this was a simpler operation than the Motais. His own difficulty with the Motais had been that the little strips of tendon slipped back through the skin of the lid. Since that happened it had been his practice to take a shaving of the sclerotic at the insertion of the tendon, and if one put a stitch through that shaving of sclerotic and sutured it to the skin margin, he did not think that any slipping back occurred. But if one put a stitch through the soft tendon, it sometimes cut through.

Mr. L. H. SAVIN said that this excellent result could be equalled or even better secured by using ilio-tibial band grafts. He had operated on six cases of ptosis, working with ilio-tibial band, much like doing a Gallie's operation for hernia. It was simpler not to attach the



tarsus to the superior rectus, but to carry out an operation like Hess's. In a Hess operation, when using silk, if one removed the silk afterwards, the lid tended to droop, but by using ilio-tibial band the lid could be fixed at any height and it always stayed there.

He (Dr. Savin) split the upper lid at the lid margin along A-B and made a rectangular pocket (A-B, D-C) in the edge of the lid; he then took a long Græfe knife and made subcutaneous tunnels (C-E and D-F) at each upper corner of the rectangular pocket up and out to the brow.

He took a strip of ilio-tibial band 2 in. long and 3 mm. wide and passed the ends up through the tunnels (C-E and D-F) to the brow. Ilio-tibial band was very slippery and experience showed the easiest method of manipulation was first to fix the middle of the strip into the pocket by a silk mattress suture passing through the whole thickness of the lid. The free ends of the strip were then drawn up through the tunnels by silk threads. The lid was lifted by the ilio-tibial band sling to any desired height and fixed by stitches through skin and ends of the graft.

In most cases of ptosis there was an active frontalis muscle which was utilized in this operation. He did not often utilize the superior rectus, as it tended to be a weak muscle which the patient was unaccustomed to use. In one case he inserted the central stitch too near to the lid margin and interfered with the growth of lashes there. He now placed his fixing stitch higher up to avoid that danger.

Mr. AFFLECK GREEVES (in reply) said that in one case he overdid the operation and had to do it a second time as the eye was too much exposed. The ultimate result was excellent.

The operation described by Mr. Savin would be an excellent one for cases in which no superior rectus was present, but otherwise a better cosmetic and functional result could be obtained by making use of this muscle than by any plastic operation.

Section of Laryngology.

President—MUSGRAVE WOODMAN, M.S.

[*May* 5, 1933.]

Malignant Disease of the Bronchus.

By F. C. ORMEROD.

AGRICOLA, writing in 1546, described the so-called consumption of the miners at Schneeberg in Saxony and recognized that the condition was not tuberculous. He considered that the disease was due to inhalation of dust, and it is doubtful if any more accurate suggestion as to the ætiology of the condition has been made since then. Morgagni in 1761 described some autopsies in which cancer of the lung appeared to be present.

Bayle, in 1810, in using the phrase "phtisie cancèreuse," was the first to recognize malignant disease in the lung, and to distinguish it from tuberculosis. Laennec, however, investigated the condition in its clinical and pathological aspects, and described the symptoms commonly occurring in the disease and attempted to elucidate its pathology.

In 1896 Fuchs was able to collect only 74 cases from the literature. Since that time the condition has been very fully recognized and a great number of cases reported.

The number of cases of this disease correctly diagnosed during life has greatly increased in the last ten or twelve years. This is due, to a large extent, to the improved method of examination, such as radiography and bronchoscopy, and also because physicians are now familiar with cancer of the lung. Investigation of records of post-mortem examinations suggest that this disease has increased during the present century.

It is possible here also that familiarity with the condition may be responsible for part of the increase. In this respect Fried quotes Goethe, "Man sieht nur was man weiss." On examining the figures from several pathological departments it is found that there was a definite decrease in the number of cases recorded at autopsy during the years 1914 to 1918-19. It is difficult to explain this decrease except that the interest and attention of expert pathologists were occupied elsewhere and on different lines. The increase in the number of cases diagnosed is undoubted; the real increase in the occurrence of the disease is not so certain.

The cases under review in the present paper consist of twenty-six patients examined by bronchoscopy in the Throat Department of the Brompton Hospital and one at Westminster Hospital during the past two years. In every case there had been a complete clinical and radiological examination, the latter being repeated with lipiodol injection in almost every case.

In all the cases, except four, portions of the tumour were removed, and proved by microscopical section, to be carcinoma. Of the four exceptions, two were examined

post mortem and the diagnosis was proved. In the remaining two, it was not possible, on account of the position of the tumour in one and the extreme hardness of the growth in the other, to obtain satisfactory portions for examination. In both these cases the diagnosis was so certain clinically that they are included in the list.

A further case was seen in which the clinical X-ray and bronchoscopic examination strongly suggested carcinoma, but examination of a portion of the tumour on two occasions showed inflamed mucous membrane only, and the Wassermann reaction was positive. The case is not included in the list, though its subsequent progress indicated the almost certain diagnosis of carcinoma.

ÆTIOLOGY.

Sex.—Of the 27 cases, 23 were male and four were female. This preponderance of male over female cases is recorded by all observers but is more marked than usual in the Brompton figures.

Age.—The youngest patient was a woman aged 27, and the oldest, also a woman, was aged 74. More than two-thirds of the cases occurred between the ages of 40 and 60, the two decades 40 to 49 and 50 to 59 being approximately equal as shown in the accompanying table.

Age Incidence.

Oldest, 74 years.

Youngest, 27 years.

20-29 years ...	1 case	50-59 years ...	11 cases
30-39 „	2 cases	60-69 „	3 „
40-49 „	9 „	70-79 „	1 case

Side of origin.—In many writings on the subject it is stated that the disease occurs with equal frequency on either side, but some figures show a slight preponderance on the right side. The Brompton figures show a similar lateralization, there being 15 in the right bronchial system and 12 in the left.

Occupation.—The occupation of the 27 patients included almost as many kinds of work. Of the four women three were engaged in housework, the fourth had been a missionary in Africa for many years. Of the 23 men nine might be classed as indoor workers and 14 mainly as outdoor workers. They are roughly grouped in the accompanying table.

Occupation Males.

Retail trades	6	Travellers	2
Motor drivers	2	Labourers	2
Engineers, etc.	3	Clerical...	3
Porters	3	Nil	2

From this list it is difficult to suggest any possible common ætiological character. The Registrar at Brompton hospital is however at present going into the past occupation as well as that at the time of presentation at hospital in the hope of arriving at some such factor.

Heredity does not appear to play any part. None of the cases gave a history of lung cancer in the parents; only three gave a history of cancer in the parents, though it is probable that there were more cases than this.

Previous history.—Six gave a history of influenza, 11 of pleurisy and four of pneumonia, and 11 gave no history of any previous chest trouble at all. In some cases the pleurisy was recent enough to have been possibly associated with the growth rather than previous to it. In none of these 27 cases was there a history of

tuberculosis, although one patient has recently been operated upon at Brompton with active tuberculosis and a carcinoma in the same lobe of the lung.

In two of the series of cases there was a positive Wassermann reaction, though some cases were not tested.

Symptoms.

Cough.—The most constant symptom of the disease is the cough which was present in all 27 cases. The cough is dry in character in many cases and was noted as excessive in only one case.

Sputum.—Sputum is fairly constant, being absent in only two cases. It was noted as being excessive in two patients. It is usually mucopurulent in character and contains pyogenic organisms.

Hæmoptysis.—Hæmoptysis occurred to some degree in 21 cases. In most of the cases the sputum was streaked with blood especially in the earlier stages of the disease. There is a tendency for the blood to disappear at a later stage but in some cases to recur in the final stages in the form of profuse hæmoptyses. In two cases the hæmoptysis was the immediate cause of death.

Dyspnœa.—Dyspnœa on slight exertion is a striking symptom. It was complained of by 21 patients. It is often marked in cases with a small mass of growth and with a comparatively small area of lung shut off. With less than one lobe out of action—perhaps one-sixth of the available respiratory area—anything more than very gentle walking may produce distress.

Lassitude.—Lassitude is a more difficult symptom to assess but was definitely complained of in nine cases.

Loss of weight.—Loss of weight occurred in 23 cases. Losses of 2, 3 and 3½ stone were recorded before coming to hospital for examination. Many of the cases when admitted to hospital and kept in bed ceased to lose weight, and some gained a few pounds. One patient who has been under treatment and observation for two years has been steadily gaining throughout this period.

Pain.—Pain in the chest was complained of by 15 patients. It is described usually as an ache referred to the interior of the chest on the diseased side. In some cases it is referred to the posterior surface of the thorax. One patient complained of pain in the sciatic distribution, and before death had a spastic paralysis of both legs, probably due to metastases in the spine.

Hoarseness only occurred in three patients, in two of whom the left cord was fixed in the cadaveric position owing to implication of the recurrent laryngeal nerve.

Clinical Signs.

The clinical signs are those of obstructed bronchus, and usually of atelectasis or collapsed lung. In a partial obstruction there may be an expiratory wheeze with moist sounds below. In complete obstruction there is dullness on percussion, absence of breath sounds, but possibly increased vocal conduction. The heart and mediastinum may be displaced in cases of massive collapse and the movements of the corresponding half of the diaphragm reduced.

There may be localized pleural effusion.

X-ray examination shows the reduced mobility of the diaphragm, displacement of the mediastinum and a shadow in the lung tissue which is partly due to growth and partly to collapsed lung. It is very difficult to separate these two portions of the shadow.

Introduction of opaque oil into the bronchial tree at once indicates the position of the upper margin of the growth, and in cases where the obstruction is not complete may show the extent of the intrabronchial growth. The outline of the

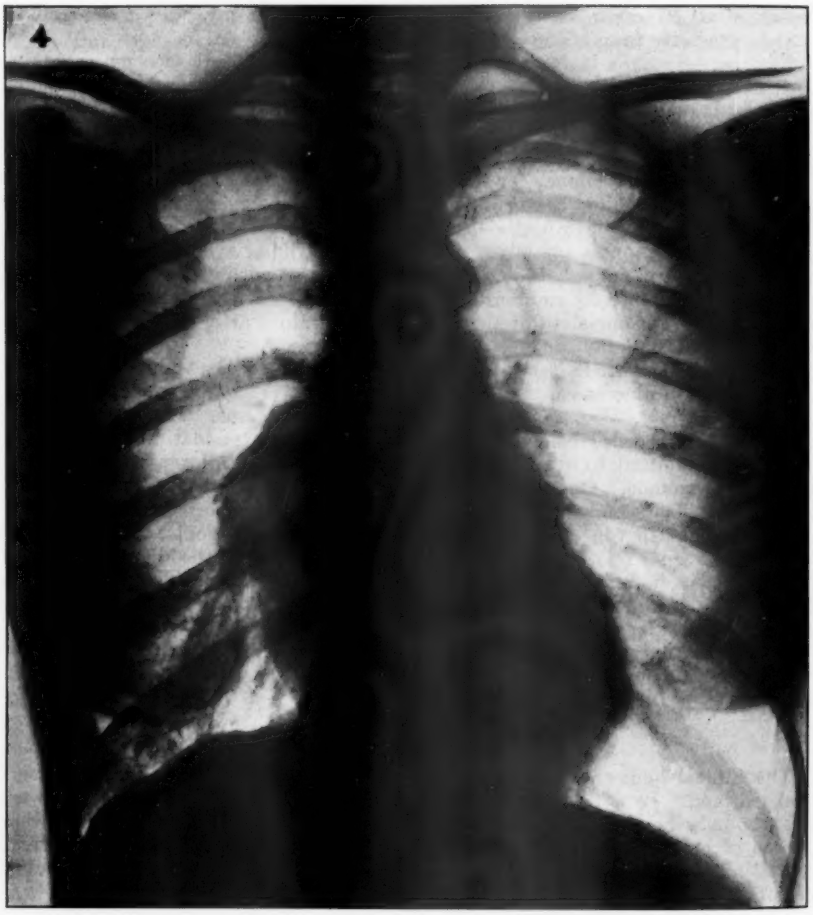


FIG. 1A.—Carcinoma of right main descending bronchus. Some atelectasis in lower lobe.

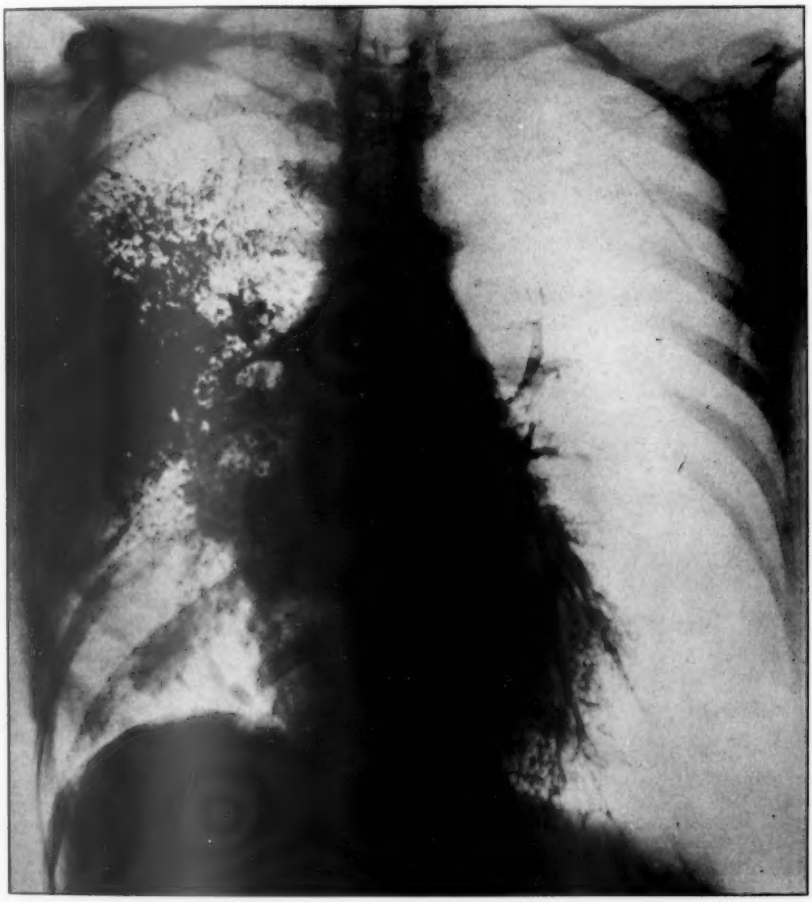


FIG. 1B.—Outline of growth in bronchus by lipiodol. No lipiodol has entered the lower lobe.

FIG. 2.—Carcinoma of left main bronchus. Complete atelectasis of left lung. Convex upper margin of growth shown by lipiodol.

FIG. 3.—Inflammatory structure of right main descending bronchus (syphilitic). Compare fusiform obstruction with appearance in figs. 1B and 2.

growth in the bronchus is almost always convex. A fusiform narrowing is probably due to chronic inflammation. Bronchoscopic examination reveals a number of characteristics of malignant growth of the bronchi. The bronchial mucosa is less

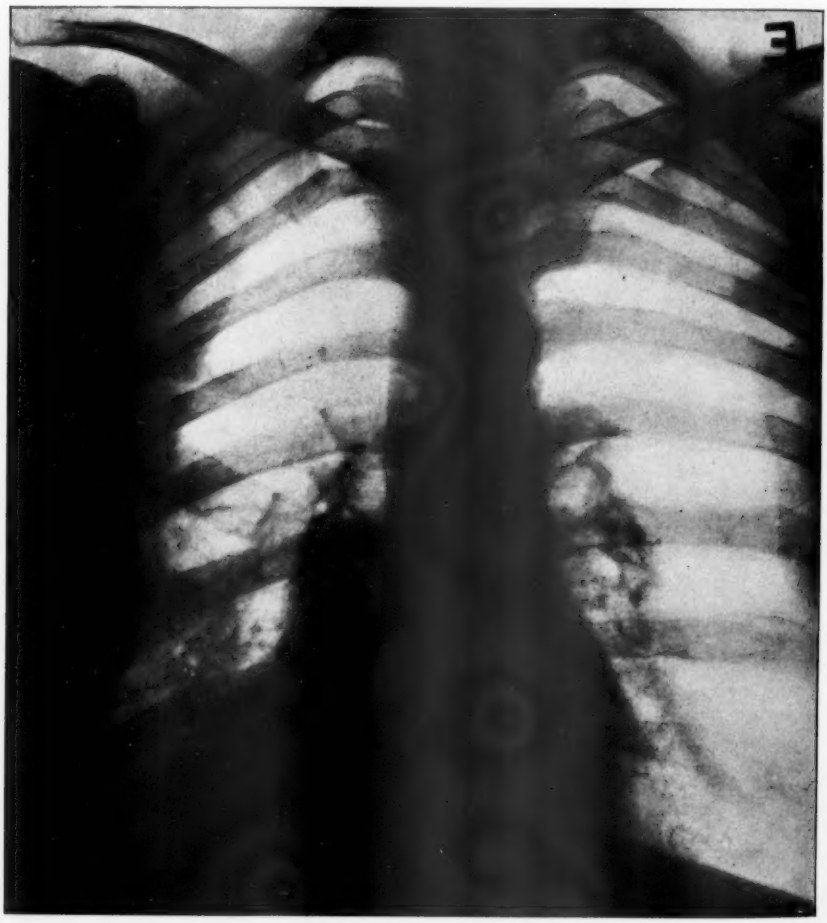


FIG. 4A.—Growth of right descending bronchus with atelectasis. Skiagram taken December 1, 1932, before radon treatment.

irritable than in cases of inflammatory disease, and the tendency to cough is less. The mucosa is rarely inflamed above the growth, and there is as a rule very little secretion.

The growth is usually of the same colour as normal mucosa, and has a nodulated surface, and the point at which it arises from the bronchial wall can be plainly

FIG. 4B.—Skiagram taken March, 1933, three months after radon treatment. Bronchus stenosed, no signs of growth, lung completely opened up. (Scattered shadows due to lipiodol.)

FIG. 5.—Cavity due to degeneration of squamous-celled carcinoma in a woman aged 74.

seen. It is firm in consistency, being even so hard as to make removal of a portion for biopsy difficult. In advanced stages the growth may be very soft and friable and portions may be coughed up.

Discussion.—V. E. NEGUS said that he had seen, seven years ago, a young woman who had hæmoptysis; she had been seen by Sir StClair Thomson, and had been in a sanatorium ten months. With the bronchoscope he (Mr. Negus) was able to see a small, semi-pedunculated growth in the left lower lobe bronchus; this he removed, and found it to be a simple fibroma. The patient was all right and her lung had been clear until five months ago, but then a larger growth was seen, in the same position, growing from the medial wall of the lower lobe bronchus. That also he removed; it looked like the previous one, but proved to be adeno-carcinoma. After removing it he put in radon seeds, with a slightly different container from that used by Mr. Ormerod; he put springs on the side the better to hold it in place. The patient was now quite well again. Early examination might disclose more of these cases.

A man with complete collapse of the right lung, whose main bronchus was obstructed by a pedunculated growth, which the speaker removed, and found to be adeno-carcinoma, was still well four years later.

He thought that the cases which Mr. Ormerod had mentioned had been chiefly those having an extension in the lung itself: but if the majority of carcinomata started in the bronchus, the conclusion was that examination of suspected cases must be allowed at an early stage, when cure might be possible; when the lung was widely invaded the chance of cure was slight, except by removal of the lung itself, a formidable procedure.

E. D. D. DAVIS asked what instruments Mr. Ormerod used and how he removed the pedunculated carcinoma, whether by the snare or by diathermy. He (the speaker) was sometimes alarmed by the hæmorrhage in these cases. In his hospital the physicians were sending more cases for bronchoscopy.

A large number of the museum specimens of carcinoma of the lung showed a conical tapering constriction of the bronchus. This tapering constriction does exist, though it is not easily seen when looking through a bronchoscope.

So far as he knew, there were only 26 cases of benign or pedunculated tumours of the bronchus recorded. Eleven of these were removed by bronchoscopy and resulted in great relief to the patient. The distressing dyspnœa was cured. The growths all occurred in the first inch or inch-and-a-half of the bronchus.

F. C. ORMEROD (in reply) said he thought the growths began in the bronchial mucosa, and he hoped to be able to show sections which would bear that statement out. Usually such cases came with completely obstructed bronchus, collapsed lung, and a mass extending into the lung, and then the outlook was bad.

He used the Irwin Moore type of bronchoscope and the Paterson type of forceps. He had not encountered sufficient hæmorrhage to cause alarm.

He agreed with what had been said about clearing enough from the bronchus to afford aeration. The degree of dyspnœa was out of all proportion to the size of the growth.

Section of Laryngology and Section of Otology.

JOINT MEETING IN ASSOCIATION WITH THE SCOTTISH SOCIETY OF OTO-LARYNGOLOGY.

Chairman—E. MUSGRAVE WOODMAN, M.S. (President of the Section of Laryngology).

[*June* 2, 1933.]

The Pathology and Treatment of Malignant Growths of the Bronchus.

By F. C. ORMEROD.

PATHOLOGY.

WHEN cases of carcinoma of the bronchus were first examined by biopsy, some surprise was expressed on finding that the carcinoma was frequently of the squamous-celled variety. Masses of squamous cells were found sometimes without arrangement, sometimes in definite columns and in some cases with keratinization and cell nests. In other cases there were masses of columnar cells, which occasionally showed attempts to form lumina. Again, there were found masses of small ovoid cells, which were once considered to represent the oat-celled sarcoma of the mediastinum but were shown by Bartlett and Barnard to be carcinoma of the lung. Recognition of these various types of new growth raised the question which tissues in the bronchus or lung could give rise to such histological pictures. The bronchial mucous membrane consists of a single layer of ciliated columnar cells supported by a layer, one or two cells deep, of smaller ovoid cells. Below this is the submucous-layer of areolar, fibrous and elastic tissue which contains large numbers of mucous glands.

Examination of specimens of bronchial mucous membrane after chronic inflammation shows a marked increase in the cells of the small ovoid layer giving rise

to projection of masses of these cells into the lumen of the smaller bronchioles. In cases in which this condition is advanced it is possible to demonstrate metaplastic changes in the cells, with a tendency to formation of squamous epithelium, more frequently in masses than in thin layers. These changes have been known for many years and are constantly observed in the Brompton Hospital. The same changes have resulted from the injection of irritant substances into the bronchial tree in animals.

It is suggested that all the different types of carcinoma arise from the layer of small ovoid cells.

It needs little imagination to associate the oat-celled tumour with these cells. Histologically they are almost identical. In some sections it is possible to see the small ovoid cells with more definitely columnar cells in the same field, such mixtures of cells occurring in tumours and in the post-inflammatory metaplasia of the ovoid cell layer. It is not difficult to suppose the further change of these cells into masses of columnar and squamous cells, in the formation of carcinomatous growth.

No section has been seen which gives the impression that the ciliated columnar cells of the bronchus or the flattened epithelial cells of the alveoli could give rise to the growth under discussion.

The squamous-celled type tends to occur in older people, the columnar and ovoid types being found among the younger cases.

There is a tendency to degeneration in the squamous-celled type of tumour. The cytoplasm of the cells disappears first, leaving masses of isolated nuclei. The nuclei may be in groups giving the appearance of multinucleated giant cells, but in other preparations the nuclei also degenerate. In these tumours the degeneration can be observed macroscopically and formation of cavities is seen. In the case illustrated, a woman, aged 74, showed a large cavity in a mass of squamous-celled carcinoma. A portion removed confirmed the diagnosis, but free cancer cells were also found in some of the secretion which was aspirated from the bronchus.

Metastases occur commonly in the mediastinal glands, whence the tumour may invade the hilum of the opposite lung. They also occur commonly in the suprarenal gland, in the liver, pancreas, brain and almost any organ.

In some cases aspiration of fragments of the growth into the bronchus of the opposite lung may give rise to secondary deposits. Progress of the tumour can be traced through the lung tissue to the pleura, and then the whole pleural surface may become studded with secondary deposits, or connected into a continuous sheet of carcinoma enveloping the lung. Such cases are sometimes described as primary tumours of the pleura but really have a bronchial origin.

I am much indebted to Dr. E. Atkin, Director of the Pathological Department at Brompton Hospital, for his help in the pathological consideration of these cases.

Treatment.

The ideal treatment of growth in the bronchi consists in complete removal.

By endoscopic means this is rarely possible, but occasionally a case is seen in which a small semi-pedunculated tumour is present in the bronchus and can be removed with forceps. Usually when first examined there is a sessile growth springing from a third or a half of the circumference of the bronchus and extending for some distance down the bronchus with extension into the lung. When a tumour can be removed, radiation also must be practised, by one of the methods to be described.

Lobectomy is being carried out in selected cases at Brompton Hospital by my colleagues, J. E. H. Roberts and A. Tudor Edwards, and encouraging results have been obtained.

The immediate mortality of the operation has been reduced, but the selection of suitable cases presents more difficulty. The disease must be limited to one lobe and

must be situated so peripherally that sufficient lung tissue can be left to secure closure of the main bronchus. The method is useful in growths of the upper lobe as endoscopic methods of treatment are difficult in these cases.

Secondary deposits in the mediastinal glands are a contra-indication to lobectomy. The majority of the cases under review were treated by the application of radium in the form of emanation. The radium element has not been used in these cases for two reasons. The impression has been obtained that tumours of the air passages respond better to the emanation than to the element, and also the possible displacement of radium element into the mediastinum or lung parenchyma would be accompanied by so much more danger than a similar accident with the emanation, that the latter has always been used.

Radon seeds are used and may be applied either through the bronchoscope or through the chest-wall after thoracotomy.

By the bronchoscope the seeds are applied in a special container of the type designed by Mr. Tudor Edwards, or the modification by Mr. Negus. A further modification has been devised with a pointed end for introduction into very hard or fibrous growths or for introduction into the upper lobe bronchus.

Originally eight seeds of 1½ millicuries were used in the container, but later twelve, giving a dose of 18 millicuries, were inserted, usually for one week. Recently larger doses of 24 millicuries have been tried. A thread can be attached to the container and it is withdrawn by traction at the end of the allotted time, or it can be removed by a second bronchoscopy.

In some cases the radon seeds were implanted directly into the tumour by means of one of Mr. Musgrave Woodman's trocars. In cases in which the main mass of the tumour is in the lung parenchyma, the seeds can be implanted through the pleural cavity after the chest wall has been opened. This method is also used when the chest cavity has been opened with the idea of performing a lobectomy and the operation has proved impossible, owing to situation or extent.

Treatment by the radium bomb has been very disappointing. No case submitted to it at the Westminster Hospital annexe has improved at all. The distance from a growth in the lung to the radium in a bomb is too great with any of the present existing amounts of radium.

Deep X-ray therapy has been slightly more encouraging and one or two cases, especially in the upper lobe, have shown some improvement.

The apparatus at the Westminster annexe generates 200,000 volts and it is hoped in the near future to be able to generate 400,000 volts, when further work will be done on these lines.

The application of endothermy has been commenced, and specially long extensible applicators of the type devised by Mr. Bedford Russell for the larynx are employed. It is as yet too early to assess the results of this method of treatment.

The result of treatment of carcinoma of the bronchus are not very satisfactory owing to the advanced stage in which most cases are seen.

One patient who was first seen over two years ago is still alive and well, and steadily putting on weight. Another has been under observation for over eighteen months, and though the mass of growth in the lung has slightly increased, it has disappeared from the bronchus and the patient is still undergoing deep X-ray therapy.

A patient exhibited at the last meeting of the Section was treated six months ago, and signs and symptoms have completely disappeared. Another, treated about the same time, has improved.

In one patient a microscopic section was made before radium application, one week after, six weeks after and three months after insertion of 18 millicuries of radon. A degenerative change in the malignant cells and their nuclei is seen until in the final section it is difficult to find any carcinoma cells.

Discussion.—THE PRESIDENT: With regard to this important subject there are two main points of interest. In the first place malignant disease of the lungs is increasing and is becoming more and more a menace to life in the towns, and therefore better methods must be designed to cope with it. The second point is that at the present moment encroachment is taking place on a sphere which should, to a large extent, be in the hands of the laryngologists.

We have to consider the limits and values of the different methods of treatment available at the present time, and make suggestions for the future. We have to consider the question of deep X-ray therapy which at present seems to have very little effect.

Then there is the question of radon. It seems to me that the present technique of putting a large quantity of radon in a tubal cavity is retrograde. Some years ago we discovered that the introduction of a large focus of radium in one spot rather tends to cause necrosis round that area, but possibly an actual increase in the rate of growth in the periphery. Anyhow we find that whenever we can space out our emanation centres through a growth, we get a very much better result. Personally I cannot see that diathermy has much future except in very localized cases. Then comes the question of surgery and great advances have been made in that direction. That is hardly within our sphere, but still it is for us to collaborate with the general surgeon and often we can help by bronchoscopy.

Mr. HAROLD KISCH: Most of the cases which have been referred to me at University College Hospital have been advanced cases and our results have been correspondingly poor. The earliest sign is an unproductive cough occurring in a middle-aged man, and I think we ought to try and urge our medical colleagues to refer such cases for examination. I have only had one case in which I have been able to obtain any good result and that was a very early case. Radon seeds were implanted. I had no difficulty in centring the radium over a large area in that particular case.

F. J. CLEMINSON: I have encountered a case of this type recently. The patient was a middle-aged man of alcoholic habit, who had on the right anterior pillar a papilloma about half the size of a little finger nail, which was thought to be becoming malignant. It was decided that this should be removed. Meanwhile, however, he complained of so much pain in the region of the left shoulder that his chest was X-rayed and a shadow, such as Mr. Ormerod has shown on the screen, was found in the left upper lobe. This lobe was removed by Mr. Tudor Edwards and the patient recovered from the operation and did very well, so that after a month I was able to remove by diathermy the growth from the right anterior pillar, with a zone of surrounding tissue. The sections showed that the base of the papilloma was infiltrated, but that the deeper tissues were in every direction free from any spread and that the growth in the lung was the carcinoma. Three or four days after the lobectomy the patient lost his voice and on examination this was found to be owing to a paralysed left vocal cord. The paralysis may have been caused by some pressure produced as a result of the operation, or by involvement of the recurrent laryngeal nerve by a secondary gland in the arch of the aorta.

Mr. ORMEROD (in reply): The typical case is that of a patient aged about 50 or 55 who has had a cough for two years, who says that for a year he coughed a little blood but that that has ceased, and he has now an ache or pain in the centre of his chest which has come on recently, also that he is losing weight. These are the symptoms which, at the age of about 55, are of importance. Very often the trouble is only bronchiectasis.

Case of Malignant Growth of the Bronchus.[1]—F. C. ORMEROD.

Male, aged 36, fish-porter.

Cough and pain in right side since June, 1932. Temperature from July to November, 1932, often up to 104° in evening. Losing weight. No sputum nor hæmoptysis. Wassermann reaction positive.

X-ray examination showed opaque area in right lower lobe. Lipiodol examination showed stenosis of right descending bronchus.

December 15, 1932. Bronchoscopy: Right main descending bronchus blocked by tumour, which was partly pedunculated, at 2½ in. from the carina.

Tumour removed and examined microscopically: undifferentiated type of oat-celled carcinoma.

[1] Shown at the meeting of the Section of Laryngology held on May 5, 1933.

December 29, 1932. Bronchoscopy: Bronchus still blocked by granular mass. Radon container, with seeds representing 18 millicuries of radon inserted. Coughed up after four days, but improvement after the treatment.

February 10, 1933.—Patient back at work and feeling well. Bronchoscopy showed stenosis of bronchus, but no sign of growth.

April 25, 1933.—Patient still well.

Progressive Granulomatous Ulceration of the Nose, ending fatally.—J. P. STEWART. (Abstract).

(1) A disease is described for which we cannot give a definite name and whose cause is very obscure; the most descriptive term is "Progressive lethal granulomatous ulceration of the nose." (2) Ten cases of this disease are reviewed. (3) The disease is practically confined to the male sex, the ratio being 9 males to 1 female. (4) Eight of the ten cases occurred between the ages of 28 and 42 years. (5) The pathological basis is unknown. From the clinical and microscopic appearances the writer concludes that the disease is not one of tumour but is essentially pyogenic—a chronic inflammatory process. "Malignant granuloma" is an unjustifiable designation. The writer finds no connection between this disease and Hodgkin's lymphogranuloma. The disease is not one of formation but of destruction, while the presence of granulation tissue may approve the term "progressive granulomatous ulceration." (6) The clinical picture is one of progressive destruction of the nose, face and pharynx. The disease is characterized by a mild leucocytosis (14,800) or a leucopenia (2,200) with the white blood-cells in their normal proportions. There is prolonged and hectic fever and frequent and severe hæmorrhages. (7) The duration of the illness is from one to two years. (8) The most marked feature of the disease is the complete absence of resistance of the patient to the infection. (9) The disease must be differentiated from ulceration occurring in the nose due to the following causes: syphilis, tuberculosis, malignancy, agranulocytosis, mycosis and myiasis group, yaws or frambœsia, leprosy, rhinoscleroma, leishmaniasis, rhino-pharyngitis mutilans (gangosa) and trophic post-encephalitic ulceration. (10) In six out of the seven cases, when bacteriological findings were given, the presence of a streptococcus in combination with a staphylococcus was reported. (11) As regards treatment, local applications proved unavailing. Radium treatment was employed in two cases with indefinite results but deep radio-therapy promised more success and deserves further trial. (12) Results of the disease: Eight patients died from the direct effects of the disease, namely, sapræmic cachexia and repeated hæmorrhage. One survived for four months after local cure before succumbing to generalized sarcomatosis cutis and one died from atypical "miners phthisis" four years after recovery from the local affection.

Case of Malignant Granuloma of the Hard Palate.—ION SIMSON HALL (introduced by Dr. LOGAN TURNER).

Patient, a young married woman, was a multipara, with healthy children Family history revealed no abnormality. Previous medical history, negative.

The disease began as a nodule which ulcerated and quickly perforated the hard palate.

Early diagnosis was syphilis. Treated as such in spite of negative findings. Successively diagnosed as tuberculosis or malignant disease; no evidence obtained of these.

Patient's general condition was good, for a considerable period; there were no glandular enlargements. Later there was a swinging temperature. Finally, apparently miliary spread took place, and patient died after a period of semi-coma. Death was hastened by debility, owing to anæmia from secondary hæmorrhages.

Report on post-mortem examination.—Secondary involvement of kidneys, liver and lung. Death was also due to basal meningitis caused by direct spread of disease through base of skull.

Difficulties in histological diagnosis. Apparently malignant disease, but not carcinoma and not sarcoma. Prevailing type of cell appears to be primitive. Collateral types of disease exist.

Cases have been recorded bearing close resemblance to this form of disease.

A Report of Seven Cases of Partial Thoracic Stomach with Short Œsophagus.—J. P. MONKHOUSE, and S. K. MONTGOMERY.

These are cases of partial thoracic stomach of mild degree. In six cases the diagnosis is confirmed by œsophagoscopy; in one it rests on X-ray evidence alone.

These cases fall into two groups, those with and those without dysphagia. Both types have pain which resembles the flatulent dyspepsia of cholecystitis.

The dysphagia is not steadily progressive as in cases of carcinoma but is intermittent, and for some time, often years, is not severe. It is due to the presence of an ulcerated stricture. Hæmatemesis may occur in both groups.

The diagnosis rests on X-ray and endoscopic examination. In the former, unless the barium is given in the manner described, the lesion is not seen, and it is essential that the passage of the opaque material should be watched on the screen in order to differentiate from a paraœsophageal hernia.

In cases with dysphagia, œsophagoscopy shows a stricture, possibly with visible ulceration, and mucous membrane removed from this level is found to be gastric in character.

In the second group no stricture is seen, but a dilatation may be observed at a level which is certainly above the diaphragm and from which gastric mucosa is obtained.

Dilatation will relieve the symptoms in the obstructive type; those without dysphagia receive some benefit from prolonged medical treatment but do not respond well.

Owing to the lack of post-mortem material many points in the pathology are still obscure.

Section of Obstetrics and Gynæcology.

President—J. P. HEDLEY, M.Ch.

[*June* 16, 1933.]

DISCUSSION ON UTERINE INERTIA.

Mr. A. C. Bell: The scientific treatment of uterine inertia cannot be established on a sure footing until the cause of the condition is known. Certain predisposing causes are mentioned in the textbooks, for example:—

Over-distension of the uterus in certain conditions is associated with weak pains.

Premature rupture of the membranes is undoubtedly associated with a high percentage of cases of inertia, but it cannot be cited as a cause when artificial rupture of the membranes is used as a means of inducing labour.

Malpresentations, such as persistent occipito-posterior positions, are common, but the non-rotation of the occiput is probably the result of the inertia and not the cause of it.

Hormones.—The rôle played by these is uncertain. Extract of the posterior lobe of the pituitary gland stimulates contraction of uterine muscle, and œstrin under experimental conditions sensitizes the uterine muscle to this substance, but there is no evidence that any hormonic disturbance is responsible for inertia, although it is possible that fear, with the liberation of adrenalin, may inhibit uterine contraction.

Mechanical interference with dilatation of the cervix by fibrosis has been suggested as a cause of the rigid cervix. Mr. Aleck Bourne and myself have had sections cut of many rigid, as well as of many normal, cervices and can find little evidence in support of this.

All that we know as to the cause of inertia is the clinical observation that the majority of cases occur in women in their first confinement, and that the nervous type of woman is especially liable to this complication.

Recently I have collected every available fact about 49 cases of severe uterine inertia which occurred among 4,500 consecutive deliveries at Queen Charlotte's Hospital. The only conclusion one can draw from these facts is that any type of woman may suffer from this complication; there is no primary avoidable factor. The type of inertia accompanied by rigidity of the cervix is the most dangerous to the mother and child and the most difficult to treat.

In considering the treatment, the cases of uterine inertia may be divided into two types:—

(1) The *mild inertia* with ineffectual colicky and painful uterine contractions, but in these cases the cervix, although slow in dilating, is thin, soft and yielding.

(2) The *severe inertia* with a cervix which is thick and rigid.

From the student's point of view, it is important that the latter condition should not be confused with prolonged labour due to malpresentations and contracted pelvis. Uterine inertia does not necessarily imply absence of pains, and it is only by the correct interpretation of vaginal examinations that the diagnosis can be arrived at. In inertia the cervix is not fully dilated, the caput on the fœtal head is small and pointed, and the presenting part is often not in contact with the cervix; there are no signs of obstruction such as are found in delayed labour due to contracted pelvis.

Treatment.—Much has been achieved by antenatal supervision in the prevention of obstetrical disasters during labour. In the present state of our knowledge we are unable to anticipate inertia, and hence prophylaxis is limited to reassurance of the patient—allaying the fear of labour, found especially among the higher classes of society—possibly combined with the administration of calcium during the latter weeks of pregnancy, as advised by some authorities.

Mild inertia usually becomes apparent during the first twenty-four hours of labour; how long labour will last it is impossible to say, but the important thing to impress upon students is that the majority of these patients will deliver themselves spontaneously, and in fact most of them have normal second-stage contractions after an inert first-stage.

The treatment should be expectant, combined with the administration of sedatives, morphia, hyoscine, and chloral and bromide. These often work in a most dramatic way in assisting dilatation of the cervix in a patient who has not been under the influence of drugs. In these cases there will sooner or later be efficient contractions, and it often happens that the onset of normal labour contractions follows the stimulation of local reflexes as may be produced by enemata, or evacuation of the bladder. Artificial rupture of the membranes is often valuable in stimulating the pains when the os is three parts dilated. The administration of pituitary extract is indicated; it does no harm and in many cases is definitely beneficial.

Active interference by manual dilatation of the cervix and the introduction of bags, is to be condemned in the milder type of case.

Any active interference should be in the interest of the child. Should the fœtal heart weaken, forceps may be applied at, or before, full dilatation and in the case of a breech presentation, the bringing down of a leg when the cervix is approaching full dilatation often stimulates the pains. Version is preferable to the introduction of a bag. In the case of twins complicated by inertia, if no pains follow the birth of the first child, the membranes should be ruptured and the second child be delivered artificially after the administration of pituitary extract.

Severe inertia becomes apparent after the patient has been a day or two in labour, when the cervix is found to be rigid and thick. This is a very serious complication of labour both for mother and child. If the child is alive and the mother's condition is good, especially if the membranes are unruptured, the question of Cæsarean section should seriously be considered, provided the patient has already been treated efficiently with sedatives.

If, however, delivery by the natural passages is decided upon, the case should be treated expectantly as long as possible; in many of these cases the patients will eventually deliver themselves spontaneously.

The only indication for active interference is deterioration in the mother's condition, which should be carefully watched for; when it does occur the patient should be anæsthetized, and if the child is alive, attempts at forceps delivery, after manual dilatation of the cervix, should be made. If the child is dead, or if manual dilatation of the cervix is not possible, perforation with weight traction by a cranioclast is to be recommended.

These cases are invariably infected after many days in labour, and the practice of incising the cervix is to be condemned, as it inevitably increases the risk of severe sepsis supervening.

In conclusion, the serious nature of prolonged inertia should be stressed. In the series of 49 cases which I have analysed, the fœtal mortality was 40% and the maternal death-rate 10%. Two deaths were attributable to chloroform poisoning, this may have been owing to the exhausted state of the patient, but it is well to remember that repeated anæsthetics are harmful, and that if the moment for interference is correctly judged only one anæsthetic may be necessary.

In a long drawn-out inertia, patience on the part of the obstetrician, combined

with experience which will tell him when the patient ceases to hold her own, are the essentials.

Repeated vaginal examinations, anæsthetics, and attempts at delivery, in fact meddlesome midwifery, exhaust and infect a patient and are undoubtedly responsible for fatal results which could have been avoided if more patience had been exercised, but we all can recall fatal results solely attributable to inertia, and it is in these cases that one always regrets not having performed Cæsarean section earlier in labour.

There are clearly two points about which we know little as yet, but which, if solved, would give us the key to the treatment of these cases. Firstly, the cause of the condition, and secondly, once established, which case is going to develop into the type of long-drawn-out inertia with rigid cervix, and which case will lead to spontaneous delivery.

Mr. C. M. Marshall: First-stage uterine inertia is commonly seen in two fairly distinct forms. In the first, the uterine contractions are of fairly normal frequency, though of short duration; they give rise to unpleasant colicky pains that usually bring about definite, though slow, dilatation of the cervix.

In the second type, the pains are rather more normal in character, but their frequency is much diminished, and there occur periods of varying length during which all contractions appear to cease, and dilatation comes to a standstill. Both types are frequently present in the same patient—one usually predominating, or the first merging gradually into the second. The former causes more distress to the patient; the latter, perhaps, more anxiety to the obstetrician.

Inertia is diagnosed by the quality and frequency of the pains. Mere prolongation of the first-stage is not necessarily indicative of inertia, and occasionally inertia may be present for varying periods when the duration of the first-stage does not exceed the normal limits.

The ultimate cause of this defective action of the uterus is still largely a matter of doubt. Endocrinology and animal experimentation have contributed largely to this subject but, so far their contributions appear to have been of little practical service in the labour ward.

Undoubtedly some of these patients present abnormally low blood-pressures, but one often finds blood-pressures of the same level in many young primigravidæ who have perfectly normal labours. That calcium may be of prophylactic use seems reasonable, if only in view of the well-known part it plays in the maintenance of cardiac tone. But more clinical investigation is required before the relative part played by either of these factors can be truly assessed.

In clinical work, however, it is possible to draw some practical inferences from what appear to be fairly evident predisposing causes.

The cases of inertia which I see occur mainly in three groups of patients:—

(1) About one-third of the cases occur in primigravidæ in whom there is some cephalo-pelvic disproportion.

(2) Cases in which the occiput presents posteriorly provide approximately another third.

(3) The remaining third is made up of the following cases: (*a*) Nervous primigravidæ in whom there is no disproportion or malpresentation; (*b*) cases of multiple pregnancy; (*c*) hydramnios; (*d*) multigravidæ.

Patients with hydramnios have little inertia if the membranes rupture early, or if they are artificially ruptured.

A considerable number of the multigravidæ who present inertia give a history of similar trouble in their previous pregnancies.

First-stage inertia in primigravidæ in whom the breech presents, is, in my experience, very rare.

It is interesting that inertia should develop in such a large proportion of cases in which the head is not fixed, or at least only imperfectly so, at the onset of labour. For, apart from the trial-of-labour cases, at least one half the cases of posterior presentation enter labour with the head movable or only lightly fixed in the brim.

One cannot help feeling that inertia of the upper contractile segment of the uterus, is often due to inadequate stimulation of the lower passive segment, and to lack of uniform contact pressure with the cervix. This, in some way—perhaps through nervous connections or through disturbing some inherent property of the uterine muscle—upsets the normal polarity between fundus and cervix. While this lack of adaptation between the presenting part and the cervix is very evident in cases of disproportion, it is not quite so clear in posterior positions of the occiput. Careful examination of these cases, however, even when the head is tightly wedged in the brim, reveals some incomplete adaptation, and this is most marked between the occiput and the posterior lip of the cervix.

Certain clinical evidence appears to support these views. Inertia is not so frequent in these cases when the membranes do not rupture prematurely. In the treatment of certain types of placenta prævia, simple rupture of the membranes is sufficient. The presenting part, however, is rarely fixed; the onset of labour is often delayed and first-stage inertia is occasionally present. The contrast is seen when Willett's forceps are applied and weight-traction is used. The head is drawn down, pains usually begin immediately, and the first-stage is normal. Again, after the half-breech has been brought down on to the cervix, a rapid first-stage almost always ensues.

Among many others, two interesting examples have recently been seen. One patient, a primigravida, in whom a large hydrocephalic head was presenting, had been in labour for twelve hours, the pains being of a short, infrequent and disturbing nature. The membranes were intact, external podalic version was performed, the breech was fixed within the next half-hour, strong contractions ensued, and a normal first-stage resulted.

The other, also a primigravida, was first seen in labour, having poor, infrequent pains, when the os was two fingers dilated. The fœtal heart sounds were not heard; no movements had been felt for forty-eight hours and the softish macerated head was felt well above the brim. Willett's forceps were applied with weight-traction; strong pains immediately ensued and she delivered herself two hours later.

Inadequate cervical stimulation will certainly not explain all cases, but it does seem to be one of the factors, both in the cause of the onset of labour and in the maintenance of normal uterine contractions.

The higher emotions, especially fear and anxiety, may have a powerful inhibitory action on the force and frequency of the pains. In many cases they seem to be the sole cause of the inertia. These emotional disturbances may, however, only appear in response to the irregular and unduly painful contractions of the uterus often met with in the cases we have been discussing, and thus a vicious cycle is set up.

Actual fatigue of the uterine muscle does not seem to occur, but only derangement of the mechanisms that control it. Even when a state of complete inertia is apparently present, the muscle is still irritable, will readily respond to pituitary extract, occasionally to quinine and almost always to a hand within the uterus. Sometimes, even when the uterus is in a state of complete inertia the pains recur after the injection of a spinal anæsthetic.

The proper management of a case of uterine inertia demands much care and thought, and the student should be taught to regard every case as potentially serious. During his living-in period it can be repeatedly demonstrated to him that, in at least 90% cases where there is no associated disproportion, the outcome is a perfectly happy one to both mother and child. In the remaining 10%, however, the presence of inertia may give rise to complications which can be of the most serious import to both. The inertia may be continued into the second, and even, third

stages; the necessity for instrumental delivery arises: the risk of infection is increased and post-partum hæmorrhage is not uncommon.

A careful abdominal and rectal examination should be made in all cases. Any disproportion or the presence of a posterior position should be discovered by these means alone. Nothing adds so greatly to the risk of these labours as repeated vaginal examinations. The need to make one should rarely occur, unless maternal indications arise which make the termination of labour desirable.

In the cases in which no other departure from the normal is present, sedative treatment is all that is required. Morphia is still the best drug at our disposal. It should be given early and not withheld until severe inertia has developed. Morphia provides periods of rest and sleep and largely removes the psychical factor. Some of its effect will be lost if distension of the bladder is not guarded against during these intervals.

Attempts to improve the contractions with drugs are usually unsatisfactory. Pituitary extract is dangerous, and quinine, by mouth or intramuscularly, is quite uncertain; only occasionally is a good result obtained.

In the posterior positions, which constitute so many of the cases, improvement in the quality and frequency of the pains is often secured by the application of Buist pads and binders.

Occasionally it becomes necessary to terminate labour before dilatation is complete. Certain principles should be observed:—

(1) So long as the membranes are intact interference is very rarely indicated.

(2) That the fœtal mortality will probably be high unless the head has been moulded and has descended at least to the position of a mid-forceps operation.

(3) Therefore the decision should be made primarily in the interests of the mother.

In four cases of severe first-stage inertia seen during the last nine months, labour was terminated by forceps; in three, after incision of the cervix and in one, after completing the dilatation manually. The results were entirely satisfactory, though one child was delivered face to pubes and another after manual rotation.

Incision probably causes less trauma and shock than manual dilatation.

I have not seen a case in which inertia was the sole indication for Cæsarean section, but in about 25% of our "failed trial labours," moderate or severe inertia was the chief reason for resorting to this method of delivery. The lower segment operation should be performed.

The question of anæsthesia used for any procedure during partial or complete inertia is an important one. Chloroform is dangerous on account of the third-stage complications that frequently follow its use; ether is more suitable, but spinal anæsthesia seems almost ideal. Both at Cæsarean sections and after instrumental delivery, one is struck by the excellent retraction that occurs after delivery of the child under spinal anæsthesia. Third-stage hæmorrhage has not been seen; pituitrin and ergot have not been necessary. Forcible and frequent uterine pains have been found to recur after spinal anæsthesia had been given to some of our patients in whom no contractions had been palpable for some hours. Time will not permit a more detailed description of the many interesting phenomena seen under the anæsthetic; but it has a very real part in the surgical treatment of these troublesome cases.

Mr. R. G. Maliphant: The term "*uterine* inertia," although strictly correct, is misleading, in so far as it tends to focus attention upon the uterus, which is innocent, and fails to bring into view the stimulating mechanism, which is at fault. A gynæcological condition which has suffered from a similar lack of perspective is primary or intrinsic dysmenorrhœa. Both conditions are disorders of function probably dependent upon hormonic disturbances, and both frequently affect the

same type of individual. In neither condition can any structural defect be demonstrated in the uterus, and both give their best results when treated along general—rather than upon local—lines.

Little is known of the cause of weak uterine action, but the scanty knowledge available is not without its bearing upon the proper management of the disorder. The initiation and continuation of uterine activity seem to be influenced, and to some extent controlled, by two main groups of stimuli, (1) hormonal and (2) psychic. From an evolutionary standpoint, the hormonal mechanism is no doubt the more important, but we know practically nothing of how it works.

The second mechanism is of more recent development. With the evolution of a more highly specialized nervous system, the mind has acquired a definite influence over uterine activity. Unfortunately this influence has nothing but deleterious consequences. It is the placid, rather than the anxious worrying type of patient who has the smooth, easy confinement, but with the march of civilization, the second type of patient is becoming more and more common.

In fact, now that such wide publicity is given in the lay press to the dangers and mortality of childbirth, it is difficult for any intelligent woman to go through pregnancy and prepare for her confinement without a certain amount of misgiving. This publicity may be necessary to stress the importance of antenatal care, but it has certain evil consequences. It thus becomes one of the most important tasks of the obstetrician during the antenatal period to earn the confidence of the patient and, by allaying unnecessary fears, to promote a healthy frame of mind towards the approaching confinement.

In view of our almost complete lack of knowledge of the physiology of uterine action, the treatment of its anomalies can be only palliative in nature. Uterine efficiency is a matter of degree; there is no sharp dividing line between the normal and the abnormal uterine contraction, and moreover there is no standard upon which the quality of either may be gauged. When confronted with a case of uterine sluggishness it is as well to consider whether it is wise to attempt to hasten, by means of hormones and oxytocics, a chain of events which we so imperfectly understand (and which for the particular individual concerned may be a perfectly normal process). The correctness of such a conservative attitude is confirmed by clinical experience. The best results are obtained in uterine inertia when the obstetric complication is neglected as far as possible, and when the accoucheur concentrates rather upon the condition of the individual as a whole. The labour is allowed to take its natural course, and the patient is made as comfortable, and fit as possible to withstand this prolonged period of effort. To this end, it is necessary to give regular nourishment to relieve the pain, and to secure regular periods of sleep. A part of the management which is particularly liable to be neglected is the administration of regular nourishment. Some claim that glucose when given, for example, in half-ounce doses, improves the quality of the uterine contractions, but what is more important is, that it combats the tendency towards acidosis, a condition which is so commonly seen in these cases of slow labour. This acidosis may assume serious proportions, and may be an important factor in the pathology of the sudden collapse which occasionally follows a protracted, but otherwise uncomplicated, labour in those cases which are sometimes labelled "obstetric shock."

Cases of uterine sluggishness complicating the first stage of labour fall into two main groups, according to whether the inertia delays progress before or after the rupture of the membranes. In the former group, active treatment is never required. The aim of the obstetrician must be to correct any mechanical condition present which interferes with good uterine action, and to conserve the mother's strength for a later period. I propose to consider briefly the management of the second type, namely, cases of uterine inertia associated with premature rupture of the bag of waters. The membranes rupture prematurely in approximately 7% of the cases delivered at

the Maternity Department of Cardiff Royal Infirmary. In some cases the rupture seems to have occurred abnormally early owing to lack of engagement of the presenting part, but perhaps more often for no apparent reason. The early rupture of the membranes, from whatever cause, is liable to be followed by disturbed uterine action. In some cases the pains merely become weaker, in others their rhythmic character is affected, but in both instances their efficiency is reduced. In cases associated with a high presenting part, the absence of the cervical reflex presumably accounts for the deterioration in the quality in the uterine contractions. It is recognized that inertia with intact membranes, is free from danger, but delay after their rupture is not in quite the same category. Now, there are four main complications for which we must be prepared; namely (1) undue compression of the child; (2) œdema of the cervix; (3) ascending intra-uterine infection; and (4) maternal exhaustion. In spite of these, however, it may be said that active interference is rarely required even at this stage, and that with sedative treatment the os will often dilate on its own account, to be followed either by spontaneous delivery or, at most, by low forceps extraction. Although patience is required in the management of these cases, it is necessary to avoid the kind of patience which will allow the child to die from compression and the mother to become totally exhausted, before deciding on any line of treatment. If there are any signs of impending maternal or fœtal embarrassment, it is justifiable to adopt any method of delivery which is not likely to injure the mother's health, and which, on the other hand, does not decrease the chances of a live birth. In order to conform with these requirements, any treatment must be essentially conservative, and shock-producing manipulations—such as rapid dilatation of the cervix—must be avoided. There can be no uniform method of treatment, and that chosen must depend upon the state of affairs found in any individual case. Only rarely, and in special circumstances, can abdominal delivery be contemplated. Cervical dilatation may be encouraged in certain cases associated with a high presenting part, by means of a hydrostatic bag, but a method which is sometimes successful and involves less manipulation is the application of Willett's forceps. Another form of treatment, of more general service in domiciliary practice, is the packing of the vaginal fornices and vagina fairly tightly with pledgets of wool soaked in glycerine.

There are two classes of case, however, which may call for special treatment. The first is the case in which the head is high, the liquor is trickling away, and there is some doubt about the posterior position of the occiput. In such a case no time should be lost in giving an anæsthetic and examining the presenting part with the whole hand. When the occiput is rotated forwards, the head usually sinks down upon the cervix, where it stimulates uterine action, and prevents the further loss of liquor.

The second class of case is the neglected case. The woman has perhaps been in labour, with ruptured membranes, for several days, and the os is still not half dilated. By this time the patient is exhausted and is very susceptible to any shock-producing manipulation. A method of vaginal delivery must be chosen which will produce the least amount of shock, and it must therefore on no account be too rapid. In such a case the child is often dead. In any event, its vitality has been greatly reduced by the prolonged exposure to pressure, and the chances of a live birth are small. The least dangerous form of delivery, from the maternal point of view, must be chosen, and a convenient and easy method is again by applying traction to the fœtal head by means of Willett's forceps. An alternative method which is suitable when the head is large and the child is dead or dying, is perforation through the narrow os, and the application of a cranioclast. To this a weight is tied, and labour is allowed to proceed slowly.

Although a discussion on the management of uterine sluggishness would be incomplete without any mention of these operative procedures, it is fortunate that

they are only very occasionally required, and as a general rule, as in so many other conditions in midwifery, a policy characterized by patience and the minimum of interference will usually give the best results.

Dr. R. Newton: In our teaching in Manchester, when considering the ætiology of primary uterine inertia, we regard the following points as being of the greatest importance.

We teach that efficient action of the uterine musculature depends on several factors. Sufficient calcium must be present in the circulating blood; there must also be sufficient pressor substances. A properly developed neuro-muscular mechanism, which is capable of normal action, is a necessity. This mechanism, according to our teaching, may be influenced favourably or unfavourably, by certain reflex stimuli, such as, for example, a full bladder, a full rectum, or the pressure on and fitting of the presenting part to the lower uterine pole. We also teach that the mental state of the patient is a very important factor. We recognize that the cases tend to fall into two groups; one in which the contractions are weak, and another in which there is lack of co-ordination. In the latter type the contractions, though irregular and ineffective, may be very painful.

Of the above points, I myself am investigating at the present time the relation of blood-pressure to the length of labour. In a series of cases which I am collecting I have not, up to now, found any intimate relation between them. It is interesting to note that in 37 cases of uncomplicated delayed labours, forming part of the first series mentioned, the average systolic blood-pressure is 123.

As to the neuro-muscular mechanism, I have little to say. I would like, however, to mention one interesting case in which the pre-sacral sympathetic nerve had been resected. This patient had a short and painless first stage of labour.

In Manchester it is taught that before the patient goes into labour it is possible to obtain some idea of the activity of the uterine muscle. It has been noticed, on abdominal palpation of the uterus in the later months of pregnancy, that there is a great difference in the reaction of the uterus to palpation. It is suggested that, where the tone is poor and palpation of the uterus alters it little, one is dealing with a so-called "sluggish" uterus, which will not contract as well as it might in labour. I have noticed this variation in tone but have not personally confirmed its relation to the length of labour. Medicinal induction of labour at term is thought to be a rational treatment in this type of case. In support of this it has been observed that, in women to whom quinine has been given in the course of a medicinal induction, the reactivity of the uterus is much increased.

The treatment of primary inertia, as taught in Manchester, is summarized as follows: The diet during pregnancy should contain sufficient calcium. In selected cases, when a "sluggish" uterus in the later weeks of pregnancy has been diagnosed, medicinal induction of labour at term is advised. We have always stressed the importance of the mental state of the patient, and we think that the judicious use of sedatives for the nervous primiparæ would save a large number of prolonged labours. The use of morphia in the first stage is strongly advised. When inertia is present, if the uterine contractions are unduly painful, as is the case when they are not properly co-ordinated, or if the patient is fatigued, a sedative must be given. Morphia is the best for this purpose.

Uterine stimulants may be useful. Quinine is suggested as being the best. If pituitary extract be given, it must only be given in small doses. The weight of obstetric opinion is against the giving of this drug. Occasionally, artificial methods of aiding dilatation of the cervix, or of exerting pressure upon it, may be required.

The choice of sedative is important. I have tried many—morphia, morphia and hyoscine, morphia-hyoscine narcosis, hyoscine narcosis, nembutal-chloral-hydrate narcosis, avertin and various proprietary compounds. A short series of labours in

which Pitkin's heavy spinocaine was used to obtain a low spinal anæsthesia, gave very poor results. Of all these sedatives, I have found morphia or morphia-hyoscine narcosis by far the best.

I have used quinine in a large number of cases, and I have found it helpful and safe when used with due caution. I have used pituitary extract both alone and combined with thymus extract, in several cases; good results were obtained in a few cases, but on the whole the method was unreliable.

I have also used ovarian residue, but this was seldom of use. In only a few cases was the course of labour shortened, but in these the remarkable point was the lack of pain accompanying the contractions.

When the above methods fail, we are left with a small residue of cases in which mechanical interference is necessary. I have used several methods—vulsellum-traction to the scalp, bags, Gerrard's cup dilator, and completion of the labour by manual dilatation or by incision of the cervix.

It is an important clinical point to decide how long a patient with uterine inertia should be left in labour. I have come to the conclusion that in most cases three days is the limit, and it has been my practice, as a rule, to complete labour at that stage by trachelotomy and forceps delivery. I have usually done this without previous resort to a mechanical dilator.

Should one decide to use a mechanical dilator, I would like to draw attention to Gerrard's cup dilator. In my experience, it is the instrument of choice. It consists of a firm thin rubber cup with stalk attached. Rolled up, it can be introduced into a cervix two fingers dilated. It does not displace the presenting part, because of its cup shape; it does not injure the presenting part, and considerable traction can be reasonably applied to it.

The following statistics obtained from a series of about 500 cases of delayed labour may be of interest. In these cases labour lasted longer than thirty-six hours.

Of these, 147 were absolutely uncomplicated cases of delay. A sedative was given, and often quinine as a stimulant. Resource to mechanical interference during the first stage was never necessary. Maternal deaths, none; stillborn children, three.

In 63 cases, early rupture of the membranes was the only complication. The treatment was as above. In six cases it was necessary to incise or dilate the cervix. Maternal deaths, none; stillborn children, three. This makes an interesting point at a time when rupture of the membranes is being used as a method of induction.

In 39 cases, an occipito-posterior position was the only complication. In two cases mechanical dilatation of the cervix was necessary. Maternal deaths, none; stillborn children, three.

In 29 cases, early rupture of the membranes was accompanied by an occipito-posterior position. In two cases, mechanical dilatation of the cervix was necessary. Maternal deaths, none; stillbirths, five.

Multiple pregnancy occurred six times. Hydramnios occurred three times.

In the remaining cases there was delay in the first stage complicated by contracted pelvis (20), contracted pelvis and early rupture of membranes (14), transverse lie (7), breech presentation (15), face (2), brow (4), spinal (1); in one, an overdose of nembutal was the cause of delay.

There were two other large groups, one of 48 cases in which there had been interference before the end of the first stage, and one of 80 cases in which delay occurred during the induction of premature labour.

Mr. A. J. Wrigley: My contribution to the discussion is concerned with the management of uterine inertia occurring towards the end of the second stage of labour. Cases in which uterine exhaustion is secondary to a mechanical obstruction are not included in the discussion. Thus we are dealing with the woman

whose labour has progressed successfully, with or without the use of analgesic drugs, to that stage at which the head of a normal infant has passed through the cervix and the cavity of a normal pelvis, reaches the pelvic floor and distends the perineum with each contraction. When this stage is reached the intensity of the pains often decreases, to the exasperation of the attendant in charge. Thus, the fœtal head was on the pelvic floor before application in 114 (80%) out of the last 140 cases of forceps delivery at the General Lying-in Hospital, and the forceps-rate at that hospital is less than 3%. The instrument is no longer required to drag a tight-fitting head forcibly through the bony pelvis; as a result of antenatal supervision its greatest use now should be gently to assist the delivery of the head through the pelvic floor and vaginal outlet.

We are taught, and we teach, that the current procedure in the event of inertia at this stage is to do nothing unless there are signs of maternal distress or fœtal distress, or unless progress is unduly delayed. This course is followed by the midwife, who really has no alternative, and in the knowledge of this fact the majority of her patients coöperate to a greater or less extent. When, however, the situation is complicated by the presence of a doctor the atmosphere is entirely different. All present, with the possible exception of the baby, realize that active help could be given. Of course the contractions might be strengthened and the delivery hastened by the injection of some preparation of the posterior part of the pituitary gland, but few, if any, would advocate the general use at this stage of this dangerous drug. Again, on the supposition that the pain produced in the final stretching of the vaginal outlet is so great as to inhibit, or even abolish, the uterine contractions, the administration of small quantities of chloroform has been advocated. It is stated that when this is done during the pains the expulsive efforts return and labour is completed in a physiological manner. Statistical and experimental evidence has been produced from Queen Charlotte's Hospital that chloroform given in this way leads to no increase in the duration of labour and no increase in the forceps rate.

My own observations are that the inhalation of the smallest quantities of chloroform in the circumstances under consideration is followed by even weaker and less frequent contractions and this means a longer wait for all concerned. There is not a shadow of doubt that in practice, whether general or special, the labour is completed with forceps in the majority of these cases. Again, we are taught, and we teach, that this instrument is to be used only under certain circumstances, of which the temporary inertia occurring at this stage—the end of labour—is not one. But after all, it is only a matter of lifting the head over the perineum, and here most medical practitioners take the law into their own hands. They possess the instrument with which they can end the labour and at once relieve the woman of her suffering, and they use it almost regularly. The instrument used, to my knowledge at any rate, both by doctors in practice and in the teaching hospitals, is the long curved forceps, with some axis-traction modification. It is an instrument of considerable weight and bulk and one with which great force can be exerted. It frequently causes damage both to the mother and child. Therefore, teachers of obstetrics limit most severely the indications for the employment of the long curved forceps, and quite rightly do not advise its habitual use for the purpose of completing the last stage of labour.

The day of this cumbersome instrument—the long curved forceps—is over. I cannot enter into the history of the instrument; it certainly was not designed merely to lift the head over the perineum. I would suggest that the long curved forceps should be relegated to the cupboard that contains the cranioclasts and cephalotribes and that it should be replaced by another and lighter instrument designed primarily for the low forceps operation. Instead of weighing nearly 2 lb., this latter weighs 11 oz. The smaller forceps can be applied with greater ease and safety. The amount of manipulation in the birth canal is negligible and the risk of introducing

infection is diminished. I believe that it would be better to advocate a more liberal use of the short light forceps in the treatment of inertia in the second stage of labour than, turning a blind eye to what is obviously a universal practice, to teach the strictly limited use of an instrument which is far too clumsy and bulky, for this purpose. An objection which will doubtless be raised to this proposition is that it will result in more instrumentation than ever. Even if this be so, we must remember that the lighter instrument can only be applied when the os is fully dilated, and only to a fœtal head that is on the perineum, that the instrument will not lock unless the head is directly in the antero-posterior position, and that far less force can be exerted with it, which means less risk of damage to mother and child. The instrument is not an additional burden to the already overstocked obstetric bag, but a substitute which will lighten it.

Miss B. Turner: For the purposes of this discussion I have analysed 400 cases of labour occurring in the Obstetrical and Gynæcological Unit at the Royal Free Hospital, to try and find what conditions lead to inertia in the third stage and how these conditions may be prevented.

I will first explain the method used in the Unit of conducting the third stage of labour, as this obviously has some bearing upon the length of time which it may take. As soon as the child is delivered and the cord severed, the patient, who has been on her side, is turned on to her back and put straight down the bed. As a rule the uterus is not touched either now or later, but the mound formed above the symphysis by the contracted uterus is carefully watched. Should this disappear, or should there be any signs of hæmorrhage, the uterus is at once palpated and rubbed up, otherwise it is left completely alone until signs of separation of the placenta are seen, that is, a lengthening of the cord, a gush of hæmorrhage, and the visible hardening and rising up of the uterus in the abdomen. When these signs are seen, the uterus is grasped and the placenta pushed out of the lower uterine segment and the vagina, unless it is expelled spontaneously which happens in quite a number of cases. No drugs, such as pituitary extract or ergot are ever given before the placenta has been expelled.

I have not considered any cases of morbidly adherent placenta or partially adherent placenta or of contraction ring, as I consider that these conditions are not due to uterine inertia but are pathological conditions of the uterus or placenta, though they, of course, prolong the third stage.

In an analysis of 100 unselected cases delivered in 1920, the average length of the third stage was 8·15 minutes and in a series taken this year it was 12·45 minutes. In 1920, this same method of treating the third stage was not employed, the hand was kept on the uterus throughout and it was continually "rubbed up." These figures, however, show that there is little difference in the time, whichever method is employed.

The criterion that I have taken as indicating inertia in the third stage is the time taken before the expulsion of the placenta and I have, therefore, investigated 100 cases in which the placenta was retained for thirty minutes or longer, and compared these with 100 cases in which the placenta was expelled in normal time.

Parity.—The parity of the patient does not seem to have much influence except in so far that the multiparæ usually have a more rapid labour throughout each stage. This is borne out in our cases. The difference, however, is very slight in the third stage. Of all the primiparæ 57% had a long third stage and 43% a short third stage.

Length of first and second stages.—The length of the labour before the third stage begins does, as one would expect, influence the length of this stage. Of 68 labours which lasted more than twenty-four hours, in 67% there was uterine inertia in the third stage and 33% were normal.

Malpresentations.—Abnormalities, such as twins, hydramnios, or breech presentations seem to have little influence. The occipito-posterior position, however, makes a considerable difference in the character of the third stage; of all the cases of occipito-posterior presentation in the series, 76% had a long third stage and only 24% a normal third stage. The recent paper of Bourne and Bell emphasizes the fact that in primary uterine inertia the posterior position is frequently found; it is, therefore, to be expected in the third stage.

Forceps, again, are one of the factors that predispose to inertia in the third stage. This, of course, may be due either to the long labour which is so frequent a precursor of forceps delivery either because of a mild degree of disproportion or because of the posterior position—or it may be due to the fairly deep anæsthesia necessary when forceps are used. Whatever the cause, we find inertia in our series 65% of all cases in which forceps were used whilst 35% were normal.

Analgesic drugs given in the first stage of labour seem to have very little effect upon the third stage, although one would have expected that the patient who, through the judicious use of analgesics in the earlier part of labour, reached the third stage comparatively fresh and in good condition, would have a well-acting uterus and a speedy separation of the placenta. This, however, is not borne out in the analysis I have made and we find that 50% of patients having morphia or opoidine have a long third stage and 50% a short one, and thus it is with all the drugs in use at the Royal Free Hospital, i.e., morphia, potassium bromide and chloral, opoidine, hyoscine, or combinations of all these drugs.

The anæsthetic used for the second stage of labour seems, on the other hand, to have some bearing upon the problem. Thus gas-and-oxygen seems to improve the tone of the uterine muscle and to hasten the delivery of the placenta. In this series 25% of all cases having only gas-and-oxygen had a long third stage, whilst 75% had a normal third stage. Should chloroform, however, be added to the gas and oxygen mixture, immediately the picture changes and we find 58% of patients having the mixture have inertia, whilst 42% have a normal time.

Ether and chloroform are seldom used alone. We have, therefore, only a few cases and I do not think that any conclusions drawn from them are of much value but such as they are, they show that the use of either of these anæsthetics increases the length of the third stage.

Conclusions.—From this analysis then, it is found that the factors that incline towards uterine inertia in the third stage are a long labour—especially with the occipito-posterior position—the use of forceps, and the addition of chloroform to the anæsthetic of choice (gas-and-oxygen).

Treatment.—Uterine inertia in the third stage should be treated as little as possible. Pituitary extract and ergot are never used in the Obstetrical and Gynæcological Unit of the Royal Free Hospital during the third stage and only very seldom in the second stage, as there is always danger of a contraction ring and severe hæmorrhage. The method of managing the third stage I have already described and this is adhered to even when there is a long wait, unless there is any hæmorrhage. After about thirty minutes, or if there is hæmorrhage, the uterus is rubbed up and the placenta expelled by Credé's method. I have looked up the number of post-partum hæmorrhages recorded in the Obstetrical and Gynæcological Unit during the past three years and find that the average number per year is only 37, which gives a percentage of the total number of deliveries of only 0·005.

Judging by this, I feel that the best treatment of uterine inertia in the third stage is patience.

I am indebted to Professor Dame Louise McIlroy for permission to use her records for the publication of this analysis.

Mr. J. M. Wyatt said that delay in the first stage of labour might be divided into two classes. In (1) when the membranes were intact, the risk to the fœtus was small. At intervals of about twelve hours, sufficient sedative to ensure six hours' rest for the mother was of great importance. The best drug for this purpose was chloral, gr. 40 (smaller doses were of little use), or paraldehyde, drm. 6 to 7, given per rectum in olive oil. In the few cases in which the head had descended to the pelvic floor at the expense of the anterior wall of the lower uterine segment, so that the os was lying high up behind, it was necessary to correct this position by pulling down the anterior lip of the cervix with the finger during several pains.

(2) When the membranes had ruptured early, in some cases the patient subconsciously contracted the muscles of the pelvic floor to ease the pain during the uterine contractions, and so prevented the head from descending and dilating the cervix. This could be easily ascertained by examination during the pain. If this was the case, a sedative drug such as was suggested under (1) prevented this action on the part of the patient, and the cervix dilated normally. If, however, this was not the case and there was no appreciable advance, with good pains, at the end of twenty-four hours, then either traction on the head with Willett's forceps or some form of hydrostatic dilator was indicated.

With regard to Mr. Bell's statement that if the membranes had ruptured, the risk of Cæsarean section was greater, he thought this was because in many cases in which the membranes had ruptured there had been a great deal of manipulation; if no examinations were made there would be no greater risk to the patient after rupture of the membranes than before.

With regard to delay in the third stage, the teaching was somewhat uncertain. The placenta, unless it was adherent, separated as the uterus expelled the body of the fœtus; when the uterine contractions were poor in strength delay occurred in the separation of the placenta from the membranes.

If, as soon as the baby's head was born, five units of pituitary extract were administered, the third stage of labour would last only five minutes and very little blood would be lost. He had carried out this procedure for fifteen years and had never had a case in which the placenta was retained.

Mr. Carnac Rivett said Mr. Newton had stated that after pre-sacral sympathectomy labour was short and the pains were good. He (the speaker) thought, however, that the mechanical stimulus of the head on the nerve-plexus of the pelvis was a definite factor in keeping up uterine contractions.

Several speakers had mentioned the giving of small doses of chloroform, only during pains. He himself was an advocate of that method of alleviating the pain of labour, but people seemed to think that he wanted to put every patient he saw under deep chloroform anæsthesia. He had said that small whiffs of chloroform would produce analgesia, which was very useful in normal labour: but that in primary inertia chloroform was contra-indicated, as it would not increase the pains, and might, indeed, seriously diminish them. In disordered uterine action, in which the pains were presumably "irregular"—though they might be regular *in time* and might cause much unpleasant sensation to the patient, they had very little effect in expelling the child—he was convinced that chloroform analgesia was better than morphia, and caused these pains to be effective in an expulsive way.

With regard to the difficulty when the head appeared on the perineum and receded between each uterine contraction: he had concluded that the main fault in those cases was the imperfect retraction of the uterus, and he suggested that Mr. Wrigley should use his forceps (which he, the speaker, admired), without even light traction, merely applying them to the head and supporting them lightly in the hand, and when the head appeared in the vulva, grasping the forceps and holding the head in sight, while allowing the uterine retraction to take place, and

when the next pain began, relaxing the hold. It would be found that with about two pains the head would be expelled without any pull. This was better than lifting the head over the perineum.

Dr. J. S. Fairbairn said that Mr. Wyatt had referred to cases of first stage inertia in the multiparous patient with a slack abdominal wall, and the head not engaging, in which labour slackened off after the os was three-fourths dilated. This was a condition frequently seen, in which rupture of the membranes precipitated delivery. These cases were so striking as to form a strong proof of the mechanical effect of the presenting part on the cervix in promoting uterine contraction. Mr. Wrigley's proposal to return to the use of the old straight forceps had been a marked contribution to this discussion, but the forceps shown did not seem to be of quite the old kind. Mr. Wrigley's doctrine seemed to be that the straight forceps could be used as soon as the head was on the perineum, and that practitioners should be advised to carry the short forceps with them. It was good advice, but it should be recognized that the question of uterine inertia had never yet been adequately tackled. The reason was that an easy way out had always been to use the forceps. He therefore insisted that it be made clear that the first object must be to secure natural function. If a woman was suffering from constipation one could clear out the fæcal mass with a spoon, but one would not rest satisfied with that. Obstetricians should not allow themselves to be short-circuited in the inquiry because it was easy to use the small forceps in practice.

Mr. Gordon Luker said none of the speakers had mentioned that uterine inertia was, to some extent, preventable, and that prophylactic treatment had therefore an important place. This consisted of the administration of calcium for the last three months of pregnancy, the giving of quinine for the last three weeks, and the employment, when full term arrived, of castor oil, a binder, a hot bath, an enema and quinine bi-hydrochloride; the latter were in common use in the medical intensive induction of labour, but were often omitted when labour began spontaneously. He, himself, had no doubt as to their efficacy.

He agreed with the use of pituitary extract at the end of the second stage of labour; his method was to give ½ c.c. of pituitary extract before resorting to forceps. If the drug did not act successfully, delivery was aided by forceps without delay.

Mr. W. C. W. Nixon said that he did not understand why so much apprehension existed over those cases in which the membranes ruptured prematurely. Rupture of the membranes was an effective method of inducing labour.

He was able to confirm the statement that fibrosis of the cervix was a doubtful pathological entity. He had arrived at this conclusion as the result of histological examination of normal cervices which demonstrated fibrous tissue in the region of the external os and little or no muscle tissue.

He was surprised that in discussing the treatment of uterine inertia, with retention of the placenta, no mention had been made of injection of the placenta with from 200 to 300 c.c. of saline solution. By increasing the bulk of the placenta in this way the inert uterus was stimulated to contract.

Mr. A. C. Bell (in reply) said he adhered to his statement that giving pituitary extract to women in the first stage of labour did no harm. He had seen dramatic results from its use in cases of inertia of the uterus. As much as 2½ c.c. had been given without any ill-effects; it could certainly do no harm in doses of ½ c.c.

With regard to rupture of the membranes, Mr. Wyatt had seemed to infer that he (the speaker) was unduly apprehensive of performing Cæsarean section in any case, whereas what he had said was that the ideal case would be one in which the mother's condition was good, the child was alive, and, preferably, the membranes were unruptured. The bacterial content of the liquor must increase hour by hour after rupture of membranes had taken place. He would like to mention one point to which he had not referred in his paper. It had been claimed that atropine would surely relax the rigid cervix, quite as much as it relaxed the pupil of the eye. That he did not believe.

Mr. Marshall (in reply) said that from his personal experience, and from what he had witnessed in the Liverpool Maternity Hospital, he did not think it was right to say that premature rupture of membranes did not increase the morbidity following Cæsarean section. In Liverpool a comparatively large number of lower segment operations was performed on this type of case. Even if an increased immunity from that operation were acknowledged, there was an increased morbidity in those cases which had had premature rupture of membranes. He agreed that this was slight, and of little significance if many vaginal examinations had been carried out, or if there had been forceps interference. He thought, however, that the lower segment Cæsarean operation definitely improved the prognosis in these cases. He had seen a considerable number of both kinds. Last year the number of Cæsarean sections in his hospital reached 130; there was a definite difference between the cases in which the membranes had ruptured prematurely and those in which they were intact the upper or lower segment operation was performed.

He hoped that Mr. Wrigley had made it clear that he meant the small forceps for the treatment of late second-stage uterine inertia only. The old type of forceps had still a very useful part in obstetric practice.

Mr. Maliphant (in reply) said that he had not had time in his paper to mention the subject of heredity in connection with long labour. He knew, as others did, of families who were deeply conscious of the prospect of long labours in those of their women who married. He had had an instructive case recently—that of a woman with a family history of long labours, who was then in her third pregnancy. At her two previous deliveries the results had been stillbirths after protracted labours; it was difficult to know what to do in such cases. This woman was treated with calcium, vitamins, etc., and whether that treatment had any effect on this—her third—labour he did not know, but the delivery had been successful, and the labour of normal duration.

Mr. Newton (in reply) said that the question of the importance of early rupture of membranes seemed still unsettled. He had not had much to do with multiparæ, but he believed that when three-fourths dilatation had been secured, rupture of membranes was often attended with good results. He looked with apprehension on early rupture of membranes in primigravidæ. In 150 cases in which the membranes were not ruptured early he had never had to interfere, but out of 60 cases in which there was nothing wrong except early rupture he had had to interfere in 6 (or 10%). That made a large difference in fœtal mortality and maternal morbidity if one had to dilate manually or mechanically, or to incise.

As to the question of Cæsarean section after rupture of membranes: It had fallen to his lot to perform most of the Cæsarean operations in the cases which had been left outside a long time and in which the membranes had ruptured, and he had not found much difference in the mortality, though there was a difference in the morbidity.

With regard to cutting the sympathetic nerve: He had only seen one case following pre-sacral sympathectomy; the patient had had only a few painful contractions, although she was well on in the second stage. This seemed to show that

the pre-sacral nerve was constituted, to a large extent, of viscero-sensitive as well as motor fibres.

Mr. Wrigley (in reply) said Dr. Fairbairn had stated that the low head, if not progressing in the second stage, was an indication for the application of forceps. In the two hospitals with which Dr. Fairbairn was associated, the forceps rate was under 3%; but if the cases had been conducted in general practice the figure would have been much higher. Students were taught that they must not use forceps, and in hospitals forceps were little used, but when the students were qualified and went into practice they used forceps for most of their cases; they seemed to lapse from their good teaching almost immediately they began to practise. Yet he (the speaker) did not think their results were any the worse on that account. He did not claim any originality for the forceps he showed; he thought they were Simson's forceps with the addition of a pelvic curve.

With regard to giving pituitary extract at the end of the second stage of labour, he was prejudiced against the drug; he had seen two cases in which collapse had followed its administration. One of these was fatal, and in the other, within ten minutes, the patient's pulse could scarcely be felt and she was severely shocked. Within three hours, however, she had recovered. The labour was short and easy. Only ½ c.c. of the pituitary extract was given. He (Mr. Wrigley) did not carry the drug in his bag.

He did not think that the long curved forceps should be abandoned, but he considered that they should only be used by those who were adept at craniectomy and other such procedures; they were not adapted to being used indiscriminately or thoughtlessly, for high head and low head.

Section of Ophthalmology.

President—A. C. HUDSON, F.R.C.S.

[*June* 9, 1933, *continued.*]

Radium in Ophthalmology: with Illustrative Cases.

By ROY WARD, M.B.

THE sphere of radium therapy in eye conditions is a limited one. The conditions which can be treated adequately by radium are few, and I find it difficult to understand the literature—particularly some papers of American origin—from which the impression is gained that radium is a panacea.

The radio-sensitivity of the various parts of the eye and its appendages has an important bearing on treatment. The ideal to be aimed at in radium therapy is the appropriate use of the difference in sensitivity between the diseased and the normal tissues. When this ideal is attained, the diseased tissues are destroyed and the surrounding tissues remain comparatively unaffected. As a general rule, undifferentiated types of growth are more radio-sensitive than more adult types. A clear distinction must be drawn between a marked degree of radio-sensitivity and curability: although the immediate response in the more anaplastic types of growth appears satisfactory, the disease may spread rapidly, and may give rise to early and general metastases.

Many papers have been published on the effect of irradiation on the normal eye and its appendages in animals, but as the technical details of the apparatus used are often omitted, these experiments are of little use in guiding the clinician. We know, however, that the conjunctiva and the eyelids are the most susceptible of the ocular structures, and that the globe is comparatively radio-resistant. The lens is an exception. The production of cataract is an important post-radiation effect, more particularly as it may not appear until a long latent period has elapsed. Evidence of this effect on the lens is difficult to assess, but there is little doubt that it does occur, particularly after gamma radiation.

The methods of treating eye conditions are two: (1) Treatment by beta rays, and (2) treatment by gamma rays. Most of the conditions for which radium is successfully used are superficial, and include lesions of the eyelids, cornea and conjunctiva. In these conditions great penetration is not required, and it is desirable, and at the same time possible, to limit the zone of irradiation to an exact area. Beta radiation is, therefore, used in the majority of cases. Prolonged gamma radiation, particularly by means of surface moulds, is likely to lead to permanent damage and should be avoided so long as the sight is good and the globe is in position.

Bearing these principles in mind, the conditions which are susceptible to beta radiation suggest themselves at once, and I propose to deal first with lesions of the limbus, conjunctiva and cornea, all of which are treated solely with beta radiation, and afterwards, to say something of conditions affecting the lids and other structures for which gamma radiation is also used.

Before dealing with individual diseases, however, I will outline the principles of the technique which is used, and which differs only in non-essential detail in the treatment of a variety of conditions. Beta radiation is completely absorbed by half a millimetre of platinum, while over 90% of the gamma radiation penetrates the same screen. For beta radiation treatment, therefore, unscreened radium—or rather radium screened with a very thin filter which is little more than sufficient to stop the alpha particle—is used. The instruments, though they differ in size, all

contain 5 mgm. of radium element per square centimetre, and the radiations emerge through a covering of Monel metal 0·05 mm. thick. Another form of applicator is the spatula, which is similarly made up, and which is convenient for use on the conjunctival surface of the lids (figs. 1 and 2).

Since exact localization is important, it is necessary to use some device by which the ordinary flat applicator can be placed exactly in position, and maintained there with as little discomfort as possible.

If special apparatus is not available, it is possible to keep the applicator in position by attaching it to a probe, and this is conveniently done by threading the probe through the rubber covering of the applicator, and fixing the probe to the skin on either side of the orbit by means of strapping.

The eye is cocainized and the patient lies on a couch; it is particularly important that he should be manœuvred into a position in which he is comfortable and relaxed. The head is placed between sandbags and the patient is told to fix his gaze on an object—we usually make a cross on the wall with strapping—and the applicator is

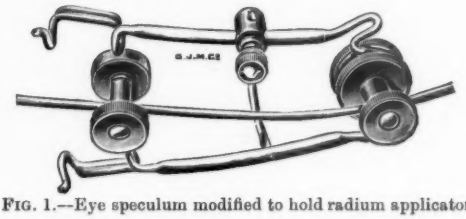


FIG. 1.—Eye speculum modified to hold radium applicator.

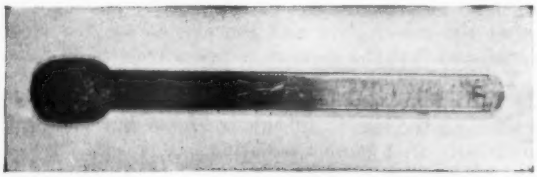


FIG. 2.—Eye Spatula.

placed in contact with the diseased area. The time during which treatment is in progress is—to say the least—tedious for the patient, and unless he is under constant supervision his attention is apt to wander. It is essential, therefore, that a nurse should watch him closely, for everything depends on the accurate apposition of the applicator to the lesion during the whole period of treatment.

So far I have dealt only with general principles and with the actual technique of radium, and I have described the latter somewhat in detail because, as you will readily understand, accuracy is of paramount importance in dealing with the localization of such a powerful source of energy as the beta ray.

The common tumours of the conjunctiva and cornea are *epithelioma* and *melanoma*. They are almost always small when first seen, and removal of portions for microscopical examination is, on the whole, contra-indicated, the evidence being that here, as elsewhere in the body, such interference encourages spread of the disease.

Epithelioma, although it may affect other parts of the conjunctiva, usually arises near the limbus—a circumstance which is favourable to the use of beta radiation, since it is easier to maintain applicators in position in this region. Treatment

consists in placing over the lesion an unscreened applicator of a size which will cover the lesion and an area of normal tissue around it. The time of application depends somewhat on the thickness of the lesion, but is usually from 45 to 65 minutes. The reaction following this treatment is usually not severe, but there is always some transient conjunctivitis, beginning as a rule from ten days to a fortnight after the application. The full effect of such treatment is not apparent until six or eight weeks have elapsed, and no further treatment should be contemplated until then. If at the end of that time the lesion has not entirely disappeared, a further application can be given. We have found that applications of unscreened radium can be given for periods up to 75 minutes without bringing about post-radiation changes in the lens or cornea.

(Case I) Epithelioma of Conjunctiva.

Patient, male, aged 64.

History.—August, 1929. Small tumour removed from conjunctiva of left eye. It had recurred after removal six months before. Prophylactic radium treatment given. Microscopical investigation showed the growth to be a squamous epithelioma.

August, 1931. Recurrence of tumour.

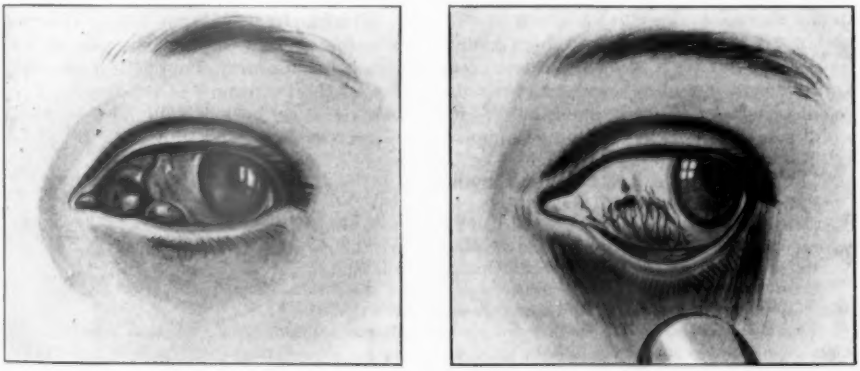
Treatment.—Treated on two occasions by unscreened radium at an interval of two months. Tumour disappeared. No recurrence.

Melanoma of the conjunctiva is a less common tumour, and arises most often in the corneo-scleral region. There is some evidence that these tumours arise on a pre-existing nævoid base, and microscopically they may resemble the pigmented nævus of the skin. The treatment of these lesions resembles that of conjunctival epithelioma. They are usually more difficult to treat, because they are more irregular in shape, so that the whole lesion cannot be treated easily at one time.

(II) Melanotic Sarcoma of the Conjunctiva.

Patient, female, aged 35.

History.—Small swelling noticed at inner corner of left eye three weeks before treatment —in September, 1931.



A B

FIG. 3.—Case II.

Condition.—As shown in fig. 3A. The upper area was pigmented, and the lower was very firm in consistency.

Treatment.—By unscreened radium by means of special eye speculum on three occasions at intervals of two months. Tumour regressed gradually after each treatment but in February, 1932, there was still a mass of growth, most marked in lower part (fig. 3B).

A high-content radon seed (10 mc.) screened with platinum 0·3 mm. was inserted beneath this for six hours.

Regression occurred and condition has since remained stationary.

(III) Melanoma of Right Eye.

Patient, male, aged 60.

History.—First treated in 1917. In 1920, most of lesion removed. Subsequently, electrolysis was used. When first seen in 1927 lesion had been rapidly increasing in size for several months.

Condition.—Pigmented lesion occupying corneo-scleral region on inner and upper quadrants.

Treatment.—By unscreened radium applicators for periods from 70 to 100 minutes, on six occasions since that time.

There is still a small area of pigment, but this is not increasing in size. A cataract has developed in the same eye.

Primary tumours of the cornea are very rare, and only ten cases of epithelioma have been seen at the Radium Institute during the last seven years. They have, however, reacted well to the same type of treatment. Tumours affecting the conjunctiva and cornea are often difficult of diagnosis, and if when first seen they are still superficial, without signs of commencing penetration of the globe, radium treatment of the kind that I have described is well worth while. Since the full effect of treatment, and therefore the susceptibility of the tumour to radiation can be assessed at the end of from six to eight weeks, little time is lost, and the reaction of many of these tumours is so satisfactory, that operative procedures can often be avoided by this means.

Mooren's ulcer is a rare type of corneal ulceration, and is exceedingly difficult to treat. I need not stress the gravity of the condition, which may become bilateral, and which, despite such treatment as scraping and cauterization, usually progresses, with disastrous results. Beta radiation being, in my opinion, the best method of treatment for early rodent ulcer of the skin, there seems to be no reason, apart from the difference in environment, why rodent ulcer of the cornea should not be treated in the same way. Though it is dangerous to give as large a dose of beta radiation to the cornea as is usually given to the skin affected by the same lesion, radium treatment, with a safe dose, has given encouraging results in the few cases which have come our way. An unscreened exposure is given for forty-five or fifty minutes and if improvement is seen at the end of six weeks, the treatment is repeated. The results are not uniformly good, but from the cases shown here it will be seen that radium is of real value in the treatment of this very serious condition.

(IV) Mooren's Ulcer (both eyes).

Patient, female, aged 36.

History.—November, 1931. Had had an ulcer on the right cornea for past nine months which was gradually progressing and spreading over the cornea.

Referred from the Central London Ophthalmic Hospital.

Condition.—Ulceration area on the nasal side of the cornea. There was some conjunctival and corneal injection at the border of this area (fig. 4A).

Treatment.—November, 1931. Unscreened plaque 5 mgm. Ra.E. Active area 1 cm.^{2}, sixty-five minutes contact radiation.

December, 1931.—Much better. Still some staining with fluorescin.

February, 1932.—Still active. Treatment repeated.

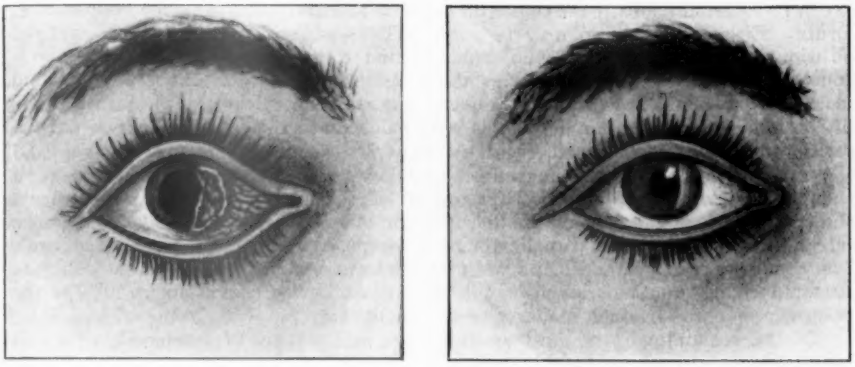
April, 1932.—Better.

June, 1932.—Small area on nasal side of left cornea with leash of vessels running into it. Both eyes treated.

August, 1932.—No active disease.

October, 1932.—No active disease (fig. 4B).

April, 1933.—Both lesions appear quiescent.



A B

FIG. 4.—Case IV.

(V) Mooren's Ulcer (right).

Patient, female, aged 55.

History. May, 1932. Excision of growth followed by application of radium at Bristol.

July, 1932. Growth reappeared; rapidly increasing in size.

August, 1932. Seen at Radium Institute.

Examination.—At the right sclero-corneal junction at 12 o'clock there was an active ulcerative opacity measuring nearly 1 cm. across, and overlapping the pupil. The sight was dim and obscured. Could only read the largest newspaper print. No diplopia.

Treatment.—Unscreened plaque. 5 mgm. Ra.E. Active area 1 cm., one hour contact radiation.

November, 1932. No evidence of any active ulceration. A very good result. Same plaque applied for forty-five minutes.

(VI) Mooren's Ulcer (left).

Patient, female, aged 63.

History.—May, 1930. Recurrent attacks of severe inflammation for eight months. Referred to Radium Institute from the Central London Ophthalmic Hospital.

Examination.—Mooren's ulcer spreading from the nasal side. The advancing edge was active, and stained irregularly with fluorescin. The older parts were vascularized and epithelialized.

Treatment.—May, 1930. Unscreened plaque 5 mgm. Ra.E; active area 1 cm., fifty minutes contact radiation.

July, 1930. Treatment repeated.

August, 1930. Apparent cure.

April 19, 1933. No sign of active ulceration.

Spring catarrh.—The only other condition affecting the conjunctiva with which I propose to deal is spring catarrh—that rare form of conjunctivitis which is again so intractable to treatment by ordinary means. We have had a number of cases to treat at the Radium Institute. In these cases the average age was 15·8 years, and males were affected in the proportion of three to one. Only six out of a recent series of 40 cases were affected on one side only, and in all except two, the palpebral conjunctiva of the upper lid was alone involved. Of these two cases, one had a lesion on the ocular conjunctiva, and in the case of the other the lower lid was affected. Treatment consists in repeated applications of unscreened radium to the conjunctival surface of the upper lid. These are conveniently made by using a special applicator, known as an "eye spatula" (fig. 2, p. 74).

It contains 3·5 mgm. of radium element and is shaped so that, after cocainization,

it can be inserted beneath the upper lid so that its distal end lies in the conjunctival fornix. Either one or two may be used. The spatula is placed in the required position and held by a nurse who stands behind the patient's head as he lies on a couch. It is essential that someone should hold the applicator all the time, and no method of mechanical fixation can replace personal supervision. The usual time is fifteen minutes, and the application is repeated at intervals of three weeks until a satisfactory result is obtained, as many as five or six treatments being given. If the reaction from such an exposure is not severe, the time may be increased, if thought advisable, up to twenty-five minutes. In cases in which the disease affects the conjunctiva at the edge of the lid, it is sometimes more convenient to evert the lid and to place an ordinary applicator on the exposed surface for the required time. The results vary a good deal and are difficult to assess because of the tendency to seasonal change and recurrence. It is safe to say, however, that about 40% of the cases can be cured by such a course of treatment.

Of the remaining cases, most are improved, while there is a minority in which radium seems to have no effect.

(VII) Spring Catarrh.

Patient, female, aged 11.

History.—Attended St. Bartholomew's Hospital 1929 and 1930 on account of spring catarrh. Several applications of radium. Last treatment March, 1931.

Examination.—May, 1931. First seen at the Radium Institute. The conjunctival surfaces of both upper eyelids were finely granular. The condition was well marked on the left upper lid and the inner third of the right upper lid.

Treatment.—May, 1931. Two eye spatulæ to left upper lid and one to inner third of the right upper lid (each spatulæ = 3·5 mgm. Ra.E). Contact radiation for ten minutes.

July, 1931.—Marked improvement in both eyes. Discharge less. Radium treatment repeated.

September, 1931.—No discharge. Still further improvement.

October, 1931.—Better. Radium to outer third of both lids.

December, 1931.—Better. Radium to outer third of left lid and inner third of right lid.

April, 1932.—Still better. Radium to outer third of both lids.

August, 1932.—Radium repeated.

November, 1932.—Small area outer quarter of right lid treated.

Present condition.—No evidence of activity.

(VIII) Spring Catarrh.

Patient, male, aged 17.

History.—Referred to the Radium Institute by the Royal London Ophthalmic Hospital.

Examination.—October, 1929. Upper lids of both eyes were covered with excessive granulations.

Treatment.—October, 1929. Radium eye spatulæ; contact radiation, fifteen minutes.

December, 1929.—Improved. Radium repeated.

January, 1930.—Radium repeated.

March, 1930.—No activity. No symptoms.

May, 1930.—Small area outer half of left upper lid. Otherwise, marked improvement.

June, 1930.—Two small patches on the outer third of left upper lid. Radium—one spatula used.

1931.—Cured.

1932 and 1933.—No return of symptoms.

(IX) Spring Catarrh.

Patient, male, aged 55.

History.—1918. Corneal ulcer: 1929, cauterization of ulcer; 1931, treatment at Guy's Hospital for corneal ulcer.

Examination.—January, 1932. Referred to Radium Institute on account of spring catarrh, affecting the right upper lid. The condition was somewhat atypical. The whole conjunctival surface of the lid was finely granular. Discharge from the eye in the morning was the principal symptom.

Treatment.—January, 1932. Two eye spatulæ (each containing 3·5 mgm. Ra.E), contact radiation, twelve minutes. Gradual improvement followed.

May, 1932.—Apparently cured.

Of the benign conditions affecting the eyelids, perhaps the most important from a radium point of view are nævi and papillomata. Another condition, but a rare one, in which radium is useful, is xanthelasma.

Nævi affecting the lids are not uncommon, and some of them grow rapidly soon after birth, so that it is usual to see these cases when the child is a few weeks old. The cavernous variety and the raised red capillary nævi are suitable for radium treatment, while the port-wine nævus is not. It is important that treatment should begin as early as possible, because the earlier the nævi are treated, the more sensitive they seem to be, and it is in the first few months of life that the cavernous nævi, at any rate, grow most rapidly. They are treated with lightly screened radium, and applicators are used of a kind which I have described, but of only half the strength; that is, they contain 2·5 mgm. per square centimetre, and they are screened by 0·1 mm. of lead. This screen has the effect of absorbing the softer beta rays.

FIG. 5.—Nævus of lower eyelid before and after treatment by radium.

Treatment should last from forty-five minutes to an hour and a half, and should be repeated either once or twice at intervals of six weeks. The effect of such treatment is gradual and not more than three treatments should be given. After that, the effect should be watched, and in the case of a cavernous nævus which is sensitive, this will be all that is required, improvement taking place over a period of six months or more after the last treatment. Excess of radiation is liable to give rise to telangiectases at a later date, and as little treatment as possible consistent with a good result is all-important (fig. 5).

Papilloma.—The commonest forms of papilloma are those affecting the upper lid, and those affecting the skin at the palpebral margin. They are usually of the papillated or filiform variety, and although electrolysis removes very small lesions satisfactorily, radium gives better results in the larger growths. Papillomata are radio-sensitive and can usually be cured by unscreened applications for from an hour to an hour and a half. An interesting type of wart is the tar papilloma, which is important, not only because it occurs fairly commonly in workers with gas tar and pitch, and various other products of the distillation of coal, but because if it is not treated it may become epitheliomatous. Tar papilloma is very radio-sensitive and disappears almost without exception after one application. It occurs most commonly on the hands and face, and the upper eyelid is sometimes affected (fig. 6, p. 80).

During the last few years twenty pitch warts affecting the lids have been seen at the Radium Institute. Fourteen of these affected the upper lid and six the lower.

Xanthelasma is liable to occur on either lid, and patients are sometimes seen who ask for treatment on account of the unsightly appearance of the yellow, plaque-like patches. Beta radiation, used so as to produce a brisk reaction, causes the areas to disappear, leaving a thin soft scar which is almost unnoticeable.

Malignant growths of the eyelids comprise epithelioma and rodent ulcer.

Epithelioma occurs either as the hypertrophic type, with a centre which tends to undergo necrosis, or as an ulcer with hard, everted edges. When the lesion is superficial and does not involve the tarsus, beta radiation is the method of choice. An exposure of from one hour to one hour and twenty minutes, to unscreened radiation, will usually get rid of the disease. Gamma radiation should be used in the more extensive cases, especially when there is underlying infiltration. External gamma radiation by means of moulded apparatus should be avoided, except in special

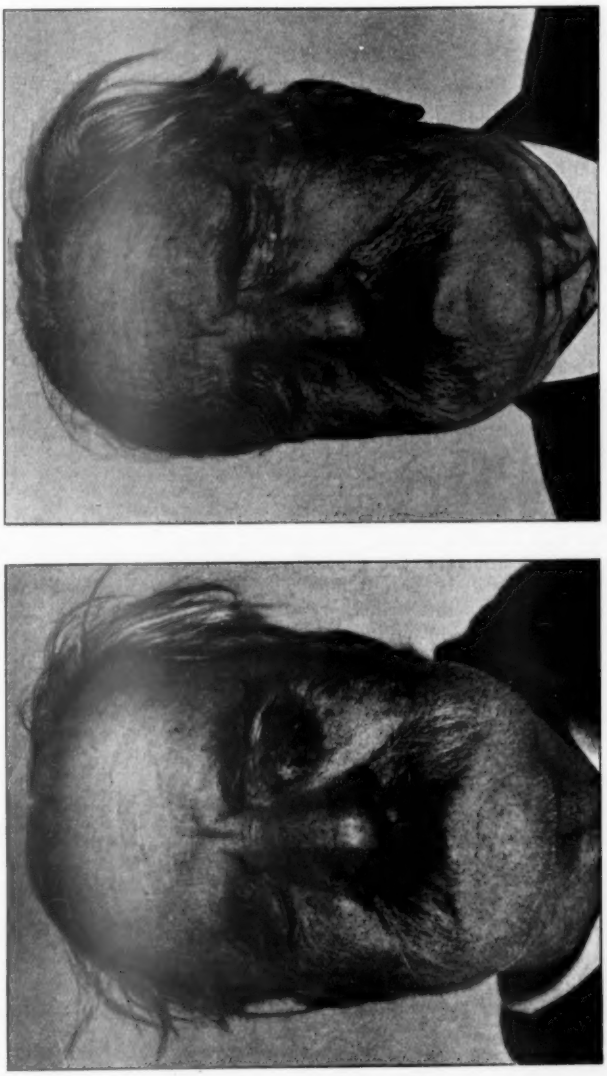
FIG. 6.—Pitch wart on upper eyelid.

cases because of the danger of damage to the eye. Interstitial gamma radiation is the method of choice as it can be more easily localized. We have found that radon seeds are more satisfactory than radium needles. They are easily inserted and removed, and because of their small size can be placed exactly in the desired position even when an irregular lesion is being treated. The comparatively short time, three or four days, during which they are in position makes the decay factor of radon less important as compared with a longer period. The seeds used contain from 1·5 to 2·0 millicuries of radon and are screened with 0·3 mm. of platinum. They are left in position for three or four days, depending on the dose required and the size of the lesion. In cases in which the disease has spread to the bony orbital walls, radium treatment is handicapped, and in most cases removal of the disease with the diathermy knife is the safest procedure, followed by irradiation with heavily screened radium.

(X) Squamous Epithelioma (Upper Eyelid).

Patient, male, aged 78.

History.—First noticed two months previous to examination (fig. 7A).



B

A

FIG. 7.—Case X.

Examination.—April, 1932. Fungating growth 1 in. in diameter on left upper lid. Attached to upper tarsal plate but not penetrating through to the conjunctiva. Microscopical section: Squamous epithelioma.

Treatment.—April, 1932. Interstitial radiation, 15 mgm. Ra.E. in six needles. Screen 0·3 mm. plat., ninety-six hours.

Result.—Apparent cure (fig. 7B).

Rodent ulcer may affect the lids, especially the lower, but the commonest situation in relation to the eye is of course the inner canthus. In this latter situation, owing to the small amount of tissue between the skin and the underlying bone, early and efficient treatment is essential. Where the lesion is not extensive, beta radiation should be used, the dose being less than that in rodent ulcers of the soft parts, on account of the presence of underlying bone. If the lesion is an extensive one, radon seeds with a screen of 0·3 mm. of platinum and a content of 2 millicuries should be inserted around the lesion for four days. The results of this method are good and the scar is, as a rule, unobtrusive and supple (figs. 8, 9, 10, 11).

(XI) Rodent Ulcer of Left Inner Canthus.

Patient, female, aged 54.

History.—History dates back to 1924 or 1925. Several applications of CO_2 snow.

Examination.—Typical rodent ulcer. 1·2 by 1 cm. extending deeply into the canthus, and affecting the inner third of both lids.

Treatment.—April, 1930. 1 radon seed; screened plat. 0·3 mm. five days, and 5·0 mgm. Ra.E in radium plate; unscreened one hour. Contact radiation.

Result.—Cure: no further treatment. Free from recurrence three years.

An interesting type of rodent ulcer in the neighbourhood of the inner canthus is that which spreads subcutaneously into one or other lid, usually the upper. In extensive growths of this type, the growing edge may extend at some distance from the original ulcer, and feels firm and smooth. It may appear not to be attached to the skin in most of its extent. Such growths are almost always radio-sensitive.

Rodent ulcers of the lower lid may—rarely—give rise, after treatment, to some ectropion, but this is usually remedied by a simple plastic operation, using a Thiersch graft.

(XII) Rodent Ulcer of Lower Lid.

Patient, male, aged 75.

History.—Three years' duration, with gradual extension, despite treatment with local applications at an ophthalmic hospital for a year and a half. Constant discharge and occasional bleeding.

Condition.—When first seen in April, 1932, there was a hard nodular growth of inner half of left lower lid, and ulceration of outer half; hard fixed mass extending backwards along orbital floor. Marked entropion of lid with contraction. Conjunctivitis severe.

Treatment.—Insertion of eight radon seeds. Screen 0·3 mm. plat. Content 2 mc. each. Time, five days. Healing took place with little reaction. Conjunctivitis much less severe.

The more extensive rodent ulcers, involving bone, are, like epitheliomata, more resistant to radiation treatment, and if the lesion does not respond quickly, diathermy should be used. When the process has extended deeply into the orbit, the eye should be removed, not only to make sure of the extent of the disease, but also to make adequate treatment possible.

Mikulicz's disease.—This disease is, in connection with the lachrymal glands, exceedingly rare, and I only mention it in passing because it is very radio-sensitive. It usually affects the salivary glands, but may also affect the lachrymal glands. It consists of an intense infiltration of the stroma of the gland by lymphocytes, which are probably the most radio-sensitive cells in the body.

FIG. 8.—Hypertrophic rodent ulcer before and three months after treatment.

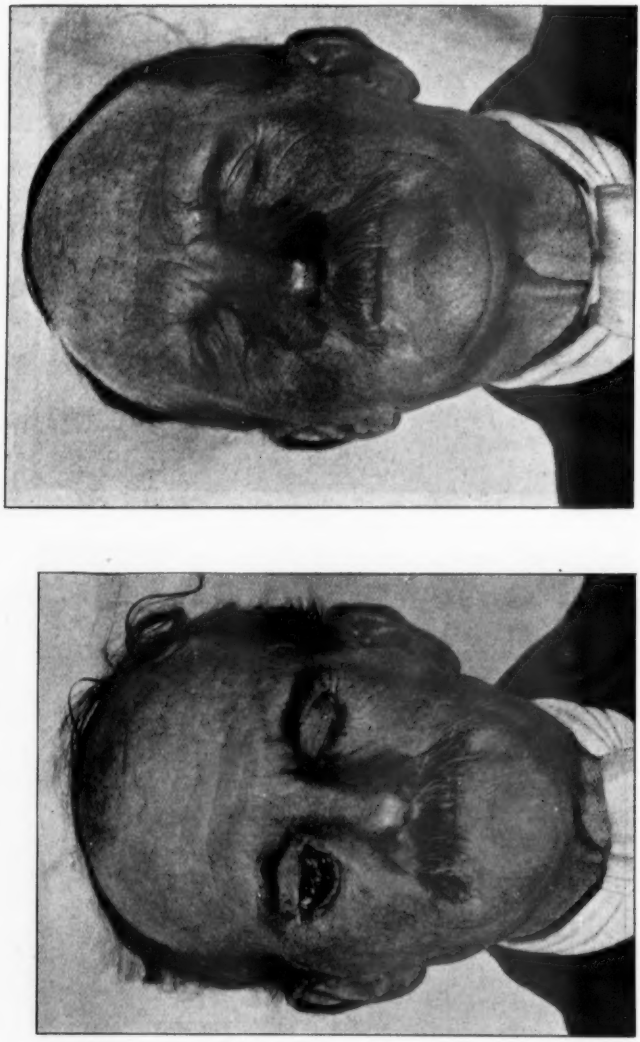


FIG. 9.—Rodent ulcer of lower eyelid treated with radon seeds.

FIG. 10.—Rodent ulcer, showing superficial and deep ulceration before and after treatment.

FIG. 11.—Multiple rodent ulcers before and three months after treatment.

These tumours disappear with remarkable rapidity with very small doses of gamma radiation applied externally (fig. 12).

There are certain other conditions for which radium, largely in the form of gamma radiation, has proved useful. *Glioma of the retina* is one of these, and its treatment of course, is primarily surgical. It is, however, very radio-sensitive. The illustrations are from the case of a baby, aged 2 years, who had had exenteration of the orbit performed, followed by a rapidly growing recurrence (fig. 13A). The extreme radio-sensitivity of the growth can be seen from the second photograph (fig. 13B) which shows the condition three years after treatment. Shortly after this the child died from metastases. The fact that the disease is often bilateral (1 in 5 in one series of cases) and that parents so often refuse to have the remaining eye removed, has led Foster Moore, Stallard, and Milner to carry out some exceedingly interesting experimental therapy with radon seeds. Mostly in cases in which the remaining eye has become affected, they have used seeds of varying content, up to 5 millicuries, and screened with 0·5 mm. of platinum, and they have been inserted by exposing the sclera and by incising it, the seed being introduced into the growth through the incision, and being left in position for ten days. The cases have been few, but certain conclusions have been formed as a result of a brilliant piece of work. Glioma has been made to disappear by this method, and the information gained by these workers will prove invaluable for future treatment, and we look forward to further results.

Retrobulbar tumours, choroid sarcomata and other tumours growing from the more inaccessible parts of the orbit are not suitable for radium treatment as a primary measure. In most cases, exenteration of the orbital cavity is necessary. When possible this should be followed by a prolonged gamma radiation of the affected region as a prophylactic measure: for this purpose a moulded wax plaque should be made to cover the supra-orbital, orbital, infra-orbital, and temporal regions. Multiple foci should be arranged in such a way as to obtain, as far as possible, a homogeneous dose through the orbital cavity. As large a dose as is consistent with skin tolerance should be given. At a skin distance of 2 cm. with a filtration of 2 mm. of lead, it is possible to use an intensity of 2 mgm. of radium element for each square centimetre of surface. About 200 mgm. are necessary. The plaque is applied intermittently for a total period of from 120 to 140 hours, the treatment lasting from eight to ten days.

[Figs. 1 to 5, 7, and 10 to 13, are reproduced from "Recent Advances in Radium," by Roy Ward and A. J. Durden Smith (London, 1933), by kind permission of Messrs. J. and A. Churchill.]

(XIII) Recurrent Sarcoma of Orbit.

Patient, female, aged 4.

History.—February 2, 1930. Complete exenteration of orbital contents by Mr. Armstrong on account of a rounded, rapidly growing mole between the globe and the inner side of the orbit. Microscopical section: Sarcoma (endothelial type). April 31, 1930. Recurrence of tumour. Firm swelling at the inner and upper angle of the orbit which has increased in size during the past fourteen days.

Examination.—May 23, 1930. Admitted Radium Institute. Swelling has increased—firm, nodular. Measures 5 by 3·5 cm. Patient's general condition very poor. Complains of headache and vomiting.

Treatment.—Interstitial radiation: Twelve radon seeds each 2 mc., screen 0·5 mm. gold, implanted permanently. *Surface radiation:* 30 mgm. Ra.E., screen 2 mm. lead. Total exposure thirty hours.

Result.—Apparent cure. Alive and well (three years after).

(XIV) Recurrent Sarcoma of Choroid.

Patient, female, aged 35.

History.—Evisceration of orbit nine months before being seen. Six months later had pain in orbit, and a month before being seen at the Radium Institute, was diagnosed as recurrent.

FIG. 12.—Mikulicz's disease with marked involvement of the lachrymal glands. Treated with surface radiation.

A B

FIG. 13.—Glioma of the retina (recurrent).

Condition.—August, 1931. Orbit filled with red œdematous tissue. Hard, and mottled with black pigment. Much œdema of lids and discharge.

Treatment.—Insertion of ten radon seeds. Screen, 0·5 mm. gold. Content, 1·8 mc. each. Left in situ permanently. Two months later very little change in condition.

Further treatment.—January, 1932. Insertion of radium needles. Screen, 0·6 mm. platinum. Content, three of 2 mgm., and three of 3 mgm. Linear intensity 1 mgm. Time four days. Followed by external irradiation by moulded plaque. There remains some induration in orbital floor. No evidence of recurrence, and patient is comfortable.

(XV) Lymphosarcoma of Orbit.

Patient, female, aged 66.

History.—Had noticed right eye swollen for a year. In July, 1932, a month before he came to the Radium Institute, the orbit was explored and a portion of growth was removed for microscopical examination which revealed a lymphosarcoma.

Condition.—Marked proptosis, and displacement upwards of right eye. External rotation *nil.* Tumour palpable in floor of orbit and extending outwards and upwards on outer wall. Sclera injected. Vision almost *nil.*

Treatment.—External irradiation to right orbit by moulded wax plaque. Distance 2 cm., 60 mgm. radium. Screen, 2 mm. lead (equiv.). Time 120 hours.

After a brisk reaction, the tumour disappeared, and there is now no sign of disease.

Most patients have some general disturbance which varies from lassitude and anorexia to incessant vomiting. There is usually some transient œdema during treatment. From ten to fourteen days after the beginning of treatment the skin becomes markedly erythematous and there may be some superficial vesication. The hair falls out over a considerable area, but this will begin to grow again about three months later.

Except in the case of rapidly growing anaplastic tumours, the effect of treatment cannot be judged for about three months.

From what I have said it will be inferred that the field of radium therapy in ophthalmology is a limited one. The danger of deleterious after-effects on such structures as the lens and cornea, limits the use of external gamma radiation either to conditions where the effect on these structures has to be ignored on account of the gravity of the condition, or to post-operative recurrences, and in both these instances gamma radiation has proved its use.

Radium therapy has been boomed, and it has been decried, and it is only now finding its level. It is as important that its limitations should be realized as that its success should be known, and I have tried in this short paper to convey some idea of both, in so far as it affects ophthalmology.

Discussion.—Mrs. PHILIPPA MARTIN said that her experience with radium was practically confined to interstitial irradiation with screened radium (gamma radiation). She had had no experience of treating actual ocular conditions. She considered that all but the most superficial rodent ulcers should be treated by interstitial irradiation. Scarring of the skin and the occurrence of telangiectasis were so much more common and more severe after beta, than after gamma, irradiation. In the case of inoperable retro-ocular tumours the treatment by irradiation was not impossible. If the tumour was involving the bone at the back of the orbit it was not possible to get behind it, but if needles were inserted by the lateral route, as well as around the globe from the front, the whole field could be adequately irradiated. It was possible to place the needles quite accurately.

Mr. AFFLECK GREEVES said he had had some experience of radium treatment in eye cases at the Middlesex Hospital. He had had two cases of epithelioma of the lids treated with radium and the growths had disappeared rapidly and completely. In both of these the upper lid was involved and the result of surgical treatment would therefore probably have been very different. Rodent ulcers, if they involved the conjunctiva, were not so satisfactorily dealt with by radium, though those confined to the skin did very well on this treatment. If a rodent ulcer had invaded the conjunctival surface it was better to excise the affected parts as freely as possible.

In his spring catarrh cases the results of treatment with radium had proved disappointing and he gathered that this was also Dr. Roy Ward's experience. On the other hand, lymphomata treated by radium had disappeared in a most impressive way. He had not tried radium treatment for Mooren's ulcer. Incidentally he wished to protest against the view that Mooren's ulcer was in any way related to rodent ulcer of the skin. Nor did he agree that spring catarrh was a conjunctivitis.

He had seen some very bad results from radium treatment of xanthelasma; the scars and telangiectases were more unsightly than the original lesions. The cases to which he referred had not been treated at the Middlesex Hospital.

With regard to glioma, he suggested that in cases of bilateral glioma, external application of radium should be tried. He had had the opportunity of treating one case in that way at the Middlesex Hospital about two years ago; a wax mask was made to cover the eye and to hold the radium in position, and a prolonged dose of radium was given. The tumour appeared to be shrinking after the second course of treatment, but, unfortunately, the father refused to bring the patient for further treatment or observation as he had somehow obtained an impression that the child was being experimented upon. He (the speaker) had, however, heard quite recently that the child was now not only alive but able to see.

In his opinion, it would be well worth while following up that line of treatment in similar cases.

Mr. HUMPHREY NEAME said that spring catarrh often seemed to be self-limiting; it persisted for three or four years and then, with mild treatment, disappeared. He had in mind a case of the late Mr. Treacher Collins in 1902. Mr. Collins preserved the notes of the case so that he might watch it, and he, Mr. Neame, traced it in 1921. The patient had attended hospital and had had various forms of treatment—as, e.g., with copper sulphate stick and acetic acid—for the nodules on the conjunctiva. After three years the nodules had disappeared entirely. Therefore, when radium was used for spring catarrh cases for two or three years in succession, it was not fair to attribute the disappearance of the disease to the radium applications.

Mr. R. FOSTER MOORE said that, in a general way, he confirmed Mr. Neame's remarks. He was surprised that out of forty cases of spring catarrh in Dr. Ward's series, in all but two the upper palpebral conjunctiva was affected. That had not been the experience in the cases at St. Bartholomew's Hospital. He considered that there was one infallible cure for spring catarrh, and that was the passage of time. He had had a number of cases of this disease treated with radium, but without conspicuous success.

Mr. H. B. STALLARD said that, thanks to the courtesy of the Staff of the Radium Institute, he had seen there a few cases of spring catarrh treated by radium.

Among the patients who received treatment between February and May at six-week's intervals, there were none who suffered from a seasonal recurrence during the year, whereas, if the treatment was omitted in the following year, a seasonal recurrence took place. In one interesting case, one eye was treated, but not the other eye; the treated eye showed no recurrence of spring catarrh in that year, but in the untreated eye there was a recurrence of that disease. Out of twenty-two cases of spring catarrh, he was only able to convince himself of two cures. In these there were certain common features. They had the disease for only a short time: one six weeks, the other seven months. The treatment was begun at the end of the summer, and was continued until the following spring. Since then there had been no recurrence of the disease, i.e., three years later.

Had Dr. Roy Ward seen chronic conjunctivitis following such treatment? and had he had experience of corneal ulceration or corneal necrosis following the application of radium in spring catarrh?

His own feeling was that unless every other therapeutic agent had failed, treatment by radium was unjustifiable, on the ground of certain risks.

Dr. ROY WARD (in reply) said that the question of the treatment of rodent ulcer by gamma, or by beta, radiation was a very large one. Many of the patients had been treated by gamma radiation in the form of either needles or seeds. In cases with small lesions he preferred beta radiation, and his line of attack was based on twenty years' work at the Radium Institute in nearly 5,000 cases of rodent ulcer. The technique was based on the work of the late Dr. Louis Wickham, and it had not been altered, except in very minute details.

He agreed that when the rodent ulcer affected the mucous membrane of the conjunctiva it was more resistant to radium; it was the same with all epitheliomata. When an epithelioma of the lip was invading the buccal mucous membrane, it was always more resistant than when it was confined to the lip itself.

He did not doubt that the treatment of retrobulbar tumours was primarily surgical, and he did not think one could secure a homogeneous field of radiation in the orbital cavity by means of needles. Unless a lethal dose was applied to every cell which was conceivably malignant, the patient would not be cured; and in any case the patient would be left with an eye which would be no good to him if an adequate dose was given.

He did not propose to contest the remarks which had been made about spring catarrh and Mooren's ulcer. At the Radium Institute only cases of spring catarrh which had resisted all other forms of treatment were brought; they were drawn, almost entirely, from the large ophthalmic hospitals, where they had been under treatment for a long time before being handed over. What he had given in the paper was an analysis of the series of 41 cases.

In reply to Mr. Stallard: chronic conjunctivitis did occur following the treatment of cases of spring catarrh by radium, if treatment was persisted in. Treatment must be given with care, otherwise this conjunctivitis might be even more intractable than the spring catarrh. This had been commented upon by Douglas Quick, of New York, who had treated in this way about 70 cases of spring catarrh.

Section for the Study of Disease in Children.

President—LEONARD G. PARSONS, M.D.

MEETING HELD AT THE CHILDREN'S HOSPITAL,
BIRMINGHAM, ON JUNE 17, 1933.

Scurvy treated with Ascorbic Acid. — LEONARD G. PARSONS, M.D. (President).

J. F., female, aged 9 months, admitted to hospital, May 20, 1933, with the history that for a week previously both legs, particularly the right, had been tender and that whenever they were handled the child had cried. No history of injury; general health had previously been good. She had been fed on sterilized milk and had not had any fruit juice.

Condition on examination.—The child was well-nourished and not obviously anæmic. There was a well-marked "apprehensive cry" and palpation of the legs, particularly over the lower ends of the femora, and, to a lesser extent, of the arms, obviously caused severe pain. A scorbutic rosary of moderate degree was seen. The upper and lower central and lateral incisor teeth had erupted and there was considerable hæmorrhage into the gums in the region of the upper incisors. There were no obvious hæmorrhages in the retinæ or elsewhere, but the urine contained a moderate number of red blood-cells and showed a haze of albumin. The symptoms were those of a mild scurvy and this diagnosis was borne out by radiological examination (Dr. C. G. Teall).

In order that the diet in hospital should be similar to that which the child received outside she was given milk, with added malto-dextrin, that had been boiled for fifteen minutes. On May 22, 20 mgm. of ascorbic acid in two ounces of distilled water was given once and thereafter this amount was given twice a day until May 30, when, because the infant was occasionally sick and had loose stools and because improvement had occurred, the dose was reduced to 10 mgm. twice a day. Ascorbic acid in these doses was continued until June 5 when its administration was stopped; the total amount taken was 450 mgm. On May 26, after the child had had 160 mgm. in all, it was noted that there did not seem to be any great tenderness of the legs and that the gums were less spongy. After a week's treatment the tenderness of the limbs completely disappeared, the red blood-cells had disappeared from the urine and it was obvious from the radiogram that the bone was healing. Two days later the gums had almost completely cleared up and the child was convalescent after having taken 350 mgm. of ascorbic acid, an amount which is stated to be equivalent to 17½ ounces of orange juice. Skiagrams taken later show the progressive healing of the bone. This child took approximately the same time to recover as would have been expected with routine treatment with orange juice.

This is believed to be the first case of infantile scurvy cured by ascorbic acid. The ascorbic acid was obtained from Professor Szent-Györgi and placed at my disposal through the kindness of Mr. A. L. Bacharach of the Glaxo Laboratories.

Combined Cœliac and Renal Rickets.—LEONARD G. PARSONS, M.D.

M. L., a girl, aged 9 years, walked at normal age but was never able to walk any distance; attended an Orthopædic Hospital at the age of 5 years because of

inability to walk far and pain in left leg. When 6 years of age osteoclasis of the lower ends of both femora was performed and the limbs were fixed in plaster. She is said to have walked quite well three months later. Transferred to Children's Hospital, Birmingham, April, 1931, when 7 years old.

Condition on admission.—Small. Height 3 ft. $2\frac{3}{4}$ in.; weight 2 st. 10 lb. Good colour. Marked evidence of rickets; genu valgum. Anterior curvatures of tibiæ and femora, enlarged epiphyses, wrists and ankles. Spleen enlarged. Urine: Moderate degree polyuria, faint haze albumin, pyuria, no cylinduria. Skiagrams showed rickets, osteoporosis and small areas of bone absorption were to be seen in the skull.

Biochemical investigation.—Blood: Urea 75·9, non-protein nitrogen 43·9, uric acid 3·43, calcium 9·72, phosphorus 3·70 mgm.%; Calvert's test showed poor urea concentration. Fæcal analysis (five-day period), showed an excretion of 7 grm. of fat per day. Total fat 36·8%; unsaponified 18·7%, saponified 18·1%, free fatty acid 8·5%, neutral fat 10·2% of dried fæces. The blood gave hypolipæmic and hypoglycæmic curves.

Progress.—Remained in hospital and convalescent hospital for fourteen months, then developed scarlet fever and was transferred to hospital for infectious diseases. She has attended as an out-patient ever since discharge from the latter hospital. During the greater part of this period she has been on a low-fat diet and the rickets and the osteoporotic areas in the skull have healed. At one period in 1932 there was a definite recrudescence of the rickets, and at another a slight return of the osteopoietic areas in the skull. The skull has become a little woolly. Pyuria has persisted, in spite of treatment, but casts have never been seen. Intravenous pyelography was undertaken on two occasions but no evidence of excretion of uroselectan was obtained in the radiogram. The blood-urea has been constantly high, varying from 127 mgm.% to 61·4 mgm.%. The maximum urinary output has been 56 oz. per day, but the amount at times has dropped to 11 oz. The blood phosphorus has varied from 5·17 to 3·16, and calcium 10·96 to 8·76 mgm.%. This case has been treated as one of cœliac disease and radiostol has been given regularly.

Dr. R. MILLER said that there was a known association between cœliac disease and renal calculus, and suggested that the pyuria in Professor Parsons' case might be connected with the presence of a stone.

Kernicterus in a Child aged 4 months.—W. C. SMALLWOOD, M.R.C.P.

A. A., a female infant, was delivered by Cæsarean section, on account of maternal cystocele. Labour had not commenced, the head of the child had not engaged the maternal pelvis, and delivery was accomplished with ease. Jaundice appeared on the second day and rapidly became intense, the child became stuporose and on the second, third and fourth days of the illness generalized convulsions occurred at frequent intervals.

At this time the limbs developed spasticity, the legs in extension, the arms in flexion and between the convulsions a position of opisthotonos was assumed. The stools were dark green. Spleen just palpable. Liver not enlarged. Van den Bergh reaction: direct, negative; indirect, strongly positive. Lumbar puncture: clear fluid, normal pressure; no abnormality cytologically or chemically. No evidence of any sepsis neonatorum, or of intracranial or other hæmorrhages.

Treatment by daily intramuscular injections of maternal blood.

The jaundice deepened for four days and then slowly cleared up, disappearing finally after three weeks. As the jaundice disappeared some pallor of the mucous membranes became obvious.

Blood-counts.—(1) On second day of illness: R.B.C. 3,650,000; Hb. 95%; W.B.C. 7,500; reticulocytes 5·7%. No nucleated red cells seen.

(2) On eighth day: R.B.C. 4,400,000; Hb. 94%; W.B.C. 10,700; reticulocytes 3·8%. One nucleated red cell seen in counting 200 W.B.C.

(3) On 21st day: R.B.C. 4,420,000; Hb. 93%; reticulocytes 1% of red cells.

Price-Jones curves at intervals throughout the illness showed a rapid decrease in the diameter of the red cells.

The spasticity of the limbs and the opisthotonos steadily increased. Later an internal strabismus developed and bilateral primary optic atrophy was discovered. The child has never thrived and has never taken any interest in her surroundings.

Condition on examination.—The infant is much wasted, making no voluntary or involuntary movements of the limbs, which are markedly hypertonic, the arms in flexion and the legs in extension; spasticity especially marked in the adductor muscles of both thighs, causing the legs to be crossed the one over the other. Opisthotonos is extreme.

Discussion.—Dr. DONALD PATERSON said he thought that kernicterus could not be diagnosed clinically with any degree of certainty. The clinical picture apparently varied greatly, and no constant syndrome was present. He hoped that in this case the clinical diagnosis of kernicterus would be advanced only with the greatest caution.

Dr. REGINALD LIGHTWOOD said he agreed with Dr. Paterson in thinking that kernicterus should be regarded as a pathological finding which was not at present susceptible of clinical diagnosis. The case in point would allow of several conditions, including kernicterus, being brought forward as possible causes of the spasticity. Of these he, Dr. Lightwood, would mention one, namely, spontaneous subdural hæmorrhage. In icterus gravis neonatorum, during the height of the jaundice, a hæmorrhagic tendency was present. The sudden onset of spasticity, perhaps after a period of convulsions, was suggestive of spontaneous subdural hæmorrhage, particularly if the fontanelle became tense or some degree of hydrocephalus appeared.

Dr. F. PARKES WEBER thought that the present condition of spastic "amentia" might be the result of the convulsions or of the toxic condition causing the convulsions. It might be due to bilateral subdural hæmorrhage, or a great part of the cerebral cortex might have been destroyed by the selective action of the supposed toxin in question, the supposed toxin exerting a selective destructive action on the cerebral cortex, analogous to the selective destructive action of chloroform, on the hepatic parenchyma causing subacute hepatic atrophy (necrosis) in some cases of so-called "late chloroform poisoning" (cf. F. Parkes Weber, "Complete Mindlessness after Status Convulsivus associated with Ether Anæsthesia," *Brit. Journ. Child. Dis.*, 1931, xxviii, pp. 14-21).

Dr. N. B. CAPON said that he also questioned the diagnosis of kernicterus and suggested that possibly the infant had some gross deformity of the brain, such as porencephaly or cortical sclerosis.

Dr. SMALLWOOD (in reply) emphasized the absence of involuntary movements and the similarity of the condition to that in spastic diplegia. He suggested that the nervous phenomena in this case pointed to a diffuse cortical lesion rather than to an affection of the basal ganglia.

Nutritional Anæmia showing Koilonychia.—W. C. SMALLWOOD, M.R.C.P.

V. S., a male infant, aged 14 months.

Third child in family. First child died from epidemic diarrhœa; other is normal. Good colour at birth: No icterus. Mother not anæmic.

Has had pallor increasing gradually for three months and associated with the development of a peculiar dirty-brown pigmentation of the skin. This was not due to exposure to the sun.

Sore throat immediately before admission.

Diet.—Breast milk for one month, then Grade A milk till aged 12 months; since then milk, potato, a little gravy. No meat, vegetable, or other article of diet.

Condition on admission.—A child of fair development and nutrition. Fretful—crying most of the day. Skin: Rather dry, rough, with a somewhat muddy pigmentation more marked on face and hands; small area of subcutaneous bruising over right eye. Mucous membranes all very pale. No icterus. Nails: Spatulate—slightly ridged. Slight rickety rosary. Anterior fontanelle easily admitted the tip of one finger. Spleen just palpable. No enlargement of liver. Heart and lungs normal. Throat generally injected; tonsils of average size. Some mucopurulent nasal discharge. Slight enlargement of cervical lymphatic glands.

Urine contained a slight excess of urobilin and urobilinogen — no other abnormality.

Fractional test meal showed hypochlorhydria.

Blood-counts	19.5.33	29.5.33	7.6.33	13.6.33
Red cells...	3,820,000	3,780,000	4,990,000	5,200,000
Hæmoglobin	32%	34%	52%	64 %
Colour index	0·45	0·46	0·52	0·61
White cells	7,250	4,250	4,600	6,800
Reticulocytes % of R.B.C.	3·1	0·9	0·6	0·6
Volume index	0·53	0·63	0·66	0·76
Saturation	0·604	0·73	0·78	0·81
Polychromasia	+	+	+	±
Anisocytosis	+	+	+++	+++

The differential white cell count showed no abnormality.

Price-Jones curve showed microcytosis of red blood cells.

Treatment by means of "ferrofax" (containing 2½% iron, some copper, manganese and yeast extract) commenced 31.5.33.

Since treatment began the anæmia has disappeared rapidly, the nail changes are less marked, and the spleen is smaller. The urine still contains excess of urobilinogen. Skiagrams of bones normal.

Subchronic Hæmolytic (Erythronoclastic) Anæmia.—W. C. SMALLWOOD, M.R.C.P.

G. M., a male infant, aged five months. Ninth in family. Previous children: 6 healthy; 1 died at four months (convulsions); 1 has rheumatism. No miscarriages.

During pregnancy the mother was on a very poor diet, unable to afford butter or much meat.

Normal delivery at term; birth weight 8¼ lbs. Breast-fed for ten days: since then sterilized milk and orange juice, 2 drs. every two or three days. No cod-liver oil. Has steadily gained weight.

Slight cough for six or seven weeks, thought to be the herald of teething.

During the past two months has been changing colour, becoming pale, with a curious light-brown pigmentation of the skin.

For last two weeks has been in the sun and this has produced a darker pigmentation. The change in colour was noticed by the patient's private doctor who writes "For the past two or three weeks he has had this lemonish tint."

Recently the napkins have been stained dark yellow by the urine. The stools are normal in colour.

Condition on admission.—Nutrition and development good. Listless, irritable. Mucous membranes very pale. Skin waxy, with café-au-lait pigmentation. Numerous purpuric spots on abdomen, legs and face; several on hard palate. Head bossed; anterior fontanelle widely open. Rickety rosary. No teeth. Pharynx healthy. Spleen enlarged; firm; lower pole reaches to umbilicus. Liver (?) a little enlarged. A few slightly enlarged glands in neck and groin. Heart and lungs normal.

Optic fundi: pallor of retinæ, discs normal.

Urine shows excess of urobilin and urobilinogen. No other abnormality.

Skiagrams of bones show early rachitic changes with signs of healing.

Van den Bergh reaction: Negative, direct; indirect shows 0·6 units of bilirubin.

Blood: Fibrin, 0·299%; albumin, 2·3%; globulin, 3·9%. Fragility of red cells normal. Sedimentation rate (blood concentrated to contain 5,000,000 R.B.C. per c.mm.) normal. Specimens of red cells and blood plasma from patient and both parents were put up in tubes in every possible combination and incubated. The patient's serum produced hæmolysis of the red cells of both parents before hæmolysis had occurred in any other tubes. The patient's cells resisted hæmolysis longer than those of the parents.

Blood-count (9.6.33): R.B.C. 1,830,000; Hb. 46%; C.I. 1·27; W.B.C. 12,900; reticulocytes 0·4% of red cells; platelets 1,800; volume index 1·16; saturation 1·09; polychromasia very little; anisocytosis of moderate degree; macrocytosis of moderate degree; bleeding time 13 mins.: clotting time 3 mins.; clot retraction poor; neutrophil polymorphs (segmented) 15·5% (non-segmented) 11·5%; neutrophil metamyelocytes (mature) 0·5% (immature) none; neutrophil myelocytes none; neutrophil premyelocytes 0·5%; eosinophil polymorphs 1·0%; basophil polymorphs 1·0%; myeloblasts 1·5%; large lymphos. 48·0%; small lymphos. 15·0%; monocytes 5·5%; plasma cells none; normoblasts (per 200 W.B.C.) 11; macronormoblasts (per 200 W.B.C.) 2; megaloblasts (per 200 W.B.C.) 7.

A blood-count carried out on 14.6.33, three days after a blood transfusion showed R.B.C. 2,390,000; Hb. 59%; W.B.C. 10,600; platelets 115,000. No alteration in the degree of immaturity of the white cells.

Maternal Wassermann reaction positive (+ +); paternal Wassermann reaction negative.

Treatment.– A blood transfusion of 70 c.c. was given on 11.6.33. The child's general condition has improved since then. The purpura is fading, and there are no fresh spots. The urine still contains urobilinogen and urobilin in excess.

Two Cases of Coarctation of the Aorta.—K. D. WILKINSON, O.B.E., M.D.

I. The patient is a girl aged 4 years and 10 months, the third child in a family of four. The other children are healthy.

She was brought to the doctor with the complaint that she was not thriving and seemed to be rather smaller than the others were at her age. No symptoms referable to the heart were found.

On examination.—Showed some cardiac enlargement; apex beat displaced outwards; forcible. Blood-pressure 150/80 (in arm). Very feeblest pulsation palpable in right iliac artery, whereas pulsation in neck was marked and forcible. No evidence as yet of the development of a collateral circulation.

A skiagram shows considerable left ventricle hypertrophy, with the absence of the aortic knob. An electrogram shows a left preponderance.

Dr. PARKES WEBER remarked that from this case of Professor Wilkinson and from the observation of other cases it should now be admitted that a correct diagnosis of aortic isthmus stenosis in children might sometimes be arrived at by the presence of a single and simple pathognomonic sign, namely, excessive pulsation and blood-pressure in the arteries of the upper limbs and neck, with absence of obvious pulsation, or with only slight pulsation, in the arteries of the lower limbs.

II. Patient, a boy, aged 14 years, the eldest of eight.

History.—Pneumonia at age of 4 years, whooping-cough at age of 6 years. Condition of heart discovered during routine examination at school in 1931.

There is a well-marked development of collateral circulation. Internal mammary and interscapular arteries tortuous and palpable. Heart slightly enlarged. Blood-pressure 198/135 (in arm). No pulse in legs.

A skiagram shows considerable left ventricular hypertrophy with some dilatation of the ascending part of the aortic arch. An electrogram shows a left preponderance.

Preliminary Communication on the Treatment of Pneumococcal Empyema by Aspiration and Injections of Taurocholate of Soda.

By A. P. THOMSON, M.D.

THAT pneumococci are soluble in bile has long been known to bacteriologists, and it is also true that a 2% solution of sodium taurocholate sterilizes cultures of pneumococci. So far as I know, these facts were never applied to clinical medicine until it occurred to me to try the effect of introducing bile and sodium taurocholate solution into the chest cavity, after aspirating pneumococcal pus.

In the earlier cases very small quantities of sterile bile were used, for fear of possible toxic effects, either from the presence of the bile itself, or as the result of the solution of pneumococci. Experience has shown that children can tolerate amounts up to 20 c.c. of a 20% solution of taurocholate of soda without ill-effect. I now believe that the best plan is to treat these cases intensively (*see* Case IV).

As soon as it is obvious that the chest contains pus, I inject 20 c.c. of a 20% solution every other day until the pus becomes sterile or the cultures from it are feeble. Aspiration of a convenient quantity of pus is carried out just before the injection. Six cases have been treated, four with complete success. The failure in two cases was due to the introduction of a secondary infection from the skin (*Staphylococcus aureus*). Up to the time of the onset of the secondary infection, both cases were doing well, but it was considered wiser to drain them, and both recovered satisfactorily.

The occurrence of the staphylococcal infection, was, in my opinion, due to the use of an ordinary exploring needle of large bore. No secondary infections have occurred since a fine trocar and canula have been employed instead. I think that this is an important point in technique. The reason for it is that occasionally an exploring needle punches out a small area of skin and pushes it into the chest. This is less likely to happen with the use of a trocar and canula.

I have tried taurocholate in streptococcal infections and have found it valueless, but I am hopeful that it may prove of value in other local pneumococcal infections. For instance, in one case of pneumococcal arthritis I introduced a 2% solution of taurocholate into the joint, and it settled down very rapidly subsequently. I propose trying the method in cases of pneumococcal meningitis, but so far have had no opportunity.

I make no claim as yet as to the value of the method, but I think these preliminary results warrant investigation on a rather larger scale. No complication of importance has occurred; an irritable rash like measles developed in one case.

The following are abbreviated reports of the four cases shown. They have all been controlled radiologically, and seemed to have returned to normal health with no deformity of the chest, and actually with no opacity in the recent skiagrams.

I. D. L., a girl, aged 3 years.

Admitted to hospital, 24.11.32, with signs of early pneumonia at the right base. Two days later there were signs of consolidation at the left base. Crisis on November 30.

	Aspiration		Bacteriology	
Date	Pus withdrawn		Films	Cultures
Dec. 14	1 c.c. thin yellow serous fluid		No bacteria	Nil
Jan. 2	10 c.c. thick pus, left side		Pneumococci +	Pneumococci (Type 4)
,, 9	10 c.c. thick pus	1 c.c. sterile bile		
,, 13	Nil	2 c.c. ,, ,,		
,, 26	20 c.c.		Pneumococci	Pneumococci
,, 30	Nil			

Slight rises of temperature persisted for a week.

On December 9 the left chest was explored with negative results.

II. N. C., a girl, aged 5 years.

Admitted to hospital, March 7, 1933; had developed pneumonia one month previously to admission (her mother developed it two weeks later and died on the day of the child's admission to hospital).

On admission there were signs of a massive left empyema. The child was very wasted and ill. Heart much displaced to the right.

Aspiration		Sod. taurocho. 20% sol. injected	Bacteriology	
Date	Pus withdrawn		Films	Cultures
March 7	450 c.c.	10 c.c	Pneumococci ++	Pneumococci +, Group III
,, 16	210 ,,	10 ,,	,, ++	+ Group I
,, 20	120 ,,	10 ,,	,, ++	+
,, 24	210 ,,	20 ,,	,, (few)	+ Group II
,, 26	210 ,,	15 ,,		
,, 28	400 ,,	10 ,,	,, (few)	Nil
,, 30	120 ,,	10 ,,	,, (very few)	+
April 4	180 ,,	Nil	,, +	Group I
,, 8	105 ,,	15 c.c.		
,, 16	Nil	Nil		

The child's temperature remained normal for a week after first injection; rose on March 12 and remained at 101° for four days.

Immediately after the second injection and aspiration the temperature fell to normal and remained so, except for an occasional rise to 100°, throughout the remainder of the child's stay in hospital.

The general condition improved consistently.

III. G. P., male infant, aged 1 year and 5 months.

Admitted to hospital, under the care of Dr. J. M. Smellie, March 21, 1933.

Pneumonia had begun four days before admission. On admission there were signs of involvement of both upper lobes and also of bases. Temperature never settled, and signs of fluid appeared on April 3.

Aspiration		Sod. taurocho. 20% sol. injected	Bacteriology	
Date	Pus withdrawn		Films	Cultures
April 3	90 c.c.	Nil	Pneumococci +	Pneumococci, Group I
,, 4	Nil	Nil	−	−
,, 5	5 c.c.	Nil		
,, 18	150 ,,	Nil	+ moderate	+ few
,, 22	135 ,,	10 c.c.	+ moderate	++
,, 25	50 ,,	10 ,,		
,, 28	40 ,,	5 ,,		
May 1	28 ,,	8 ,,		
,, 4	60 ,,	10 ,,	+ few	+ Group I
,, 9	30 ,,	10 ,,	−	−

The temperature settled after aspirations of April 3 and 5, and remained normal until April 20, then rose to 100, but returned to normal immediately after first injection of taurocholate and never rose again.

This case is particularly interesting as an attempt was made to cure the empyema by repeated aspirations (on four occasions, from April 3 to April 18); taurocholate was only used when it became apparent that aspiration alone was unlikely to cure.

IV. P. T., a boy, aged 5½ years.

Admitted to hospital, March 25, 1933, having had symptoms of pneumococcal septicæmia three weeks before admission, from which he rallied well.

Signs of right empyema one week before admission; pus found on exploration.

Aspiration		Sod. taurocho. 20% sol. injected	Bacteriology	
Date	Pus withdrawn		Films	Cultures
March 25	275 c.c.	10 c.c.		
,, 27	90 ,,	10 ,,	Pneumococci +	+ (Type I)
,, 29	90 ,,	10 ,,		
,, 31	120 ,,	8 ,,	No organisms	Few pneumococci
April 8	90 ,,	10 ,,		
,, 17	Nil			

Temperature normal throughout. General condition improved consistently. On April 5 a widespread rash suggestive of measles developed (no fever, no Koplik's spots, and no catarrhal signs). This rash recurred at intervals for a period of three weeks.

POSTSCRIPT.—Since the above notes were written, Dr. Reginald Lightwood has drawn my attention to some abstracts of papers published by Cocchi in *La Pediatria*, 1931, cix, 1162, dealing with the treatment of purulent pleurisy in children by aspiration and injection of taurocholate of soda. Cocchi had apparently had almost complete success in fifty cases treated in this way. My results may be taken as confirming his.

Congenital Chronic Duodenal Obstruction with Peritoneal Bands.—FRANCES BRAID, M.D.

N. S., a boy, then aged 4½ years, and weighing only 23 lb., admitted to hospital in September, 1931. From early infancy he had suffered from frequent attacks of vomiting, associated sometimes with constipation and sometimes with diarrhœa. He was fed "through a bottle" for two and a half years and any attempt to give solid food caused vomiting. This difficulty with regard to solid food persisted and if forced to swallow it he vomited immediately. Sometimes "he held his stomach" as if in pain. X-ray examination showed one-third residue of meal in stomach after ten hours.

Laparotomy (Mr. Scott Mason) October 12, 1931, revealed a large stomach with normal pylorus, long first and second parts of duodenum, and peritoneal bands causing a kink in the duodenum itself and at the duodeno-jejunal flexure; these bands were divided.

The child made very slow progress during the following twelve months. In that time he gained only 2 lb. During the next six months he gained 3 lb. and his symptoms diminished more rapidly. They have now practically vanished and he takes ordinary food.

It seems that the peritoneal bands were only partly responsible for the obstruction, and his present more rapid progress (at the age of 6 years) corresponds to the spontaneous improvement noted about this age in the arterio-mesenteric group of cases of duodenal obstruction.

Discussion.—Dr. R. MILLER said that the fact that improvement was slow at first after the operation, though it was now becoming more satisfactory, suggested that there was some other obstructive factor besides that of the bands. Arterio-mesenteric compression might also be present. This was a difficult thing to recognize at operation, and would be specially so where duodenal bands were found and regarded as sufficient cause for the symptoms. The child had now reached the age when spontaneous improvement was likely to occur with regard to arterio-mesenteric compression of the duodenum, and perhaps this explanation accounted for the sequence of events in this case.

Dr. PEARSE WILLIAMS said that it was difficult in these cases to interpret the skiagrams, especially with regard to the small portion of barium which formed the residue in the duodenum. He had noted in the case of two young adults with this condition that the presence of air with a barium residue, caused by aerophagy, had greatly facilitated the reading of the picture, as the duodenum had thereby become outlined, as was the colon in a shadow film after a barium enema. He suggested that it might be of value in the infant and

young child, to introduce some air into the stomach or duodenum as the stomach became emptied of the meal, in order to obtain the same condition, a duodenum outlined with a mixture of barium and gas.

Anæmia with Leucocytosis and High Percentage of Eosinophils; ? Syphilitic Pseudo-leukæmia; ? Eosinophilic Leukæmia.—FRANCES BRAID, M.D.

Patient, a boy aged 2 years and 7 months. Mother had "nervous breakdown" in 1927; found to have positive Wassermann reaction, and was treated at general hospital for nine months; returned again for treatment when she was three months pregnant with this, her first child; treatment continued till end of pregnancy; labour complicated by adherent placenta; in January 1933, two years after treatment, her Wassermann reaction was weakly positive (± −). The child throve well. He was brought to hospital on October 18, 1932, because he had become "yellow" during the previous six months.

Condition on examination.—A well-developed and well-nourished child, obviously anæmic and of lemon-yellow colour; spleen and liver not enlarged; lymph-glands not enlarged and none shown in chest by X-ray examination. Wassermann reaction was weakly positive (± −) and remained so after provocative dose of sulphostab. Van den Bergh reaction, direct and indirect, negative.

Blood-count (21.10.32).—R.B.C. 4,340,000; Hb. 48%; C.I. 0·56; reticulocytes 1·65%; W.B.C. 13,350. *Differential*: Neutrophil polys. 28%; eosinophil polys. 12%; basophil polys. 0·5%; metamyelocytes 2·5%; lymphos., large 22%, small 25%; plasma cells 5%; monos. 9·5%.

No ova of parasites found in stools. He was given six weekly doses of sulphostab (November to December), and mercury and iron irregularly since January, while attending the out-patient department. On November 20 and 21 he had a slight febrile attack—probably throat infection—associated with enlarged tender cervical glands, but was well again on November 22. While at home in January 1933, he had an "influenzal attack"; he had otitis media in April and an attack of diarrhœa and vomiting in May. On the whole his general condition has improved considerably and he has gained weight satisfactorily; the enlargement of cervical lymph-glands persists and a small gland became palpable in the right axilla in January; skiagram of chest (16.6.33) does not reveal enlargement of mediastinal glands; the spleen has never been palpable. Wassermann reaction still weakly positive (± −). The blood-picture has varied—R.B.C. 4·3 to 4·8 million; Hb. 48% to 74%; W.B.C. 13,350 to 22,900; eosinos. 12% to 31%.

Details of examination made on June 16, 1933 are: R.B.C. 4·2 million; Hb. 64%; W.B.C. 22,100; C.I. 0·76; neutrophil segmented polys. 24·5%; neutrophil non-segmented polys. 11·5%; eosinophil segmented polys. 21·5%; eosinophil non-segmented polys. 8·5%; neutrophil mature metamyelocytes 0·5%; eosinophil mature metamyelocytes 1%; lymphos., large 12·5%, small 13·5%; monos, 6·5%.

Red cells show some anisocytosis and slight polychromasia; very little poikilocytosis; no nucleated red cells found; platelets—numerous.

Diagnosis is at present uncertain, but the mother's history cannot be ignored. Anæmia of a similar type has been described by Zanca[1] and referred to by Piney[2] and attributed by them to congenital syphilis. The general condition of the child is much better than one would expect in either leukæmia or Hodgkin's disease.

Discussion.—Dr. REGINALD LIGHTWOOD said that familial eosinophilia should be borne in mind in addition to the differential diagnoses put forward by Dr. Braid. To exclude this would require examinations of the blood of both the parents and either the uncles and aunts or the grandparents. In view, however, of the fact that the child appeared to be ill, and that the cervical and axillary glands were palpable, he also thought that both eosinophilic leukæmia and Hodgkin's disease were possible diagnoses.

[1] Zanca, G., *Arch. de Med. d. enf.*, 1926, xxix, 505.
[2] Piney, A., "Diseases of the Blood," 1932, 248.

Dr. F. PARKES WEBER said that some authorities thought that a true eosinophilic leukæmia did not exist. He believed that in every case in which the diagnosis of eosinophilic leukæmia had been suggested there had been considerable enlargement of the spleen, but this was not present in the case under discussion. In some cases of persistent blood-eosinophilia no obvious cause could be discovered and there was no evidence of any familial tendency to eosinophilia; the patients did not seem to be really ill and were ultimately lost sight of.

POSTSCRIPT (28.9.33).—The child continued to improve after a further course of injections of sulphostab, and on 31.7.33 the hæmoglobin had risen to 88% and the r.b.c. to 5·1 millions; the total leucocyte count was still 22,500 and the eosinophils had fallen to 11·5%. The Wassermann reaction was still ± −.

Histological examination of a lymph gland removed on 28.6.33 showed no evidence of Hodgkin's disease. The blood of each parent was examined and no eosinophila was found.—[F.B.]

Hirschsprung's Disease. — A. V. NEALE, M.D., and F. A. R. STAMMERS, F.R.C.S.

Mary W., aged 7 years, first came under observation at the age of 5 years, when her mother brought her to hospital because of prolonged constipation, swelling of the abdomen, and general ill-health.

Clinical examination.—Well-developed child; greatly distended abdomen; tympanitic, no ascites. No enlargement of liver or spleen. Thoracic organs normal. Rectal examination negative. Barium enema showed great dilatation of the colon (3 pints used for enema). *Diagnosis.*—Typical Hirschsprung's disease.

After preliminary preparations, excision of the pre-sacral sympathetic nerve was carried out (by F.A.R.S.). The nerve-fibres were traced up to the inferior mesenteric artery, and this part of the plexus was removed.

Previous to operation the bowels were opened only once in several days; since the operation spontaneous bowel action has been fairly regular, the longest interval being two days. It was found necessary to supply medicinally liquid paraffin and, occasionally, cascara.

The general condition is satisfactory; the abdomen is less prominent.

Considerable functional improvement of the colonic action has taken place, although a series of barium enemata have shown no great change in the size of the colon.

Dr. R. C. JEWESBURY said that several months ago he had had a case of Hirschsprung's disease in a girl aged about 5 years. Lumbar sympathectomy was performed by the late Sir Percy Sargent. Since the operation there had been some improvement in the action of the bowels, but there had not been any appreciable diminution in the size of the abdomen. He, Dr. Jewesbury, wondered how soon after sympathectomy any improvement in the condition might be expected. This was the only case which he had had treated in this way and he had not felt much encouraged by the results.

Raynaud's Syndrome, treated by Sympathectomy.—A. V. NEALE, M.D. and F. A. R. STAMMERS, F.R.C.S.

Diana B., aged 4 years, the first and only child. Breast-fed for nine months, normal feeding since. Well up to the age of 2 years, at which time occasional "swelling" of the feet and hands was noticed. Following this, slight general stiffness appeared in the arms and legs and the child complained from time to time of pain in the extremities. She began to walk and talk at the usual time; intelligence normal.

At hospital definite intermittent Raynaud syndrome of the hands and feet was discovered, associated with a certain amount of sclerodermia.

The temperature of the feet was as low as 70°, and the hand temperature usually about 90°. The mouth temperature was normal.

Thermal tests were carried out by intravenous injections of T.A.B. vaccine. Under the conditions of artificial pyrexia, the temperature of the hands and feet and mouth all reached well above the normal level, and became approximately the same. The underlying primary disturbance was considered to be connected with disorder of the sympathetic innervation of the peripheral blood-vessels, and acting on this assumption, bilateral lumbar sympathectomy was performed (by F.A.R.S.) on May 18, 1933. The left sympathetic chain was found after the removal of the para-aortic lymph tissue, by which it was enveloped; similarly so on the right side. Microscopic examination of the sympathetic tissue removed shows no definite histological abnormality, although the lymph-glands in the near vicinity showed simple inflammatory change.

Since the operation the feet have been continuously warm and dry, and the legs much less stiff; the child is better able to walk. Both hands still show trophic changes in the fingers and a certain degree of sclerodermia and intermittent vasospastic changes.

It is proposed to await the exact results of the operation, and if those are are satisfactory, cervical sympathectomy will be carried out.

Discussion.—Dr. ROBERT GITTINS: Pieces of tissue examined consisted of only very small pieces of ganglion tissue and larger pieces of lymph-glands. No definite changes of the ganglia were noted, but extremely well-marked swelling, proliferation and desquamation of the cells lining the lymph sinuses were present in all parts; this was accompanied by general congestion of blood-vessels. The changes were such as are seen in glands draining a subacute or chronic inflammatory area. Caution needs to be exercised in attributing such changes, especially in glands taken from the abdomen, as the latter tend to show them very easily. However, the changes in this case were marked and this fact, in conjunction with the close proximity of this lymph tissue to the sympathetic ganglia (removal of which has given relief), is suggestive.

Dr. PARKES WEBER said that he regarded the case as one of an angiospastic disturbance of the extremities proceeding to sclerodermia—in other words, as a case of sclerodactylia, though in sclerodactylia the upper extremities were usually chiefly affected. If one questioned any patient with sclerodactylia one generally found that the sclerodermatous change had been preceded or accompanied by angiospastic (Raynaud-like) symptoms. In regard to the nodular ("beaded") condition of tendon-sheaths at the backs of the hands the present case might be compared with that of a girl, aged 11 years, shown by Dr. L. W. Batten for Dr. H. Morley Fletcher, at a meeting of the Section on January 28, 1921[1], and the discussion on that case would apply to some extent to the present case, notably in regard to the stiffness in joints.

Tumour of Spinal Cord.—F. A. R. STAMMERS, F.R.C.S.

Joyce T., aged 8 years. Admitted May 15, 1933, with a history of: (1) Pains in back (six months). (2) Paralysis of legs (five months). (3) Incontinence of urine and fæces.

History.—During the last months of 1932 she began to have pain in the buttocks and stiffness of the back. Difficulty in walking soon followed, and she was admitted to another hospital where the condition was thought to be rheumatic. She was placed on a Bradford frame, and for a time became more comfortable. Then the weakness in the legs increased, and she lost control of the bladder.

On examination.—A wasted child obviously afraid of being moved because of the pain caused. Complete flaccid paralysis of legs. Great diminution of all sensations. Complete peri-anal anæsthesia. Reflexes below groins absent, excepting ? a feeble flexor plantar reflex. Lower dorsal and lumbar spine rigid. Passive movement of legs causes pain.

1 *Proceedings*, 1921, xiv. (Sect. Dis. in Child. 40).

Lumbar puncture.—A few drops of yellow fluid withdrawn. Queckenstedt test revealed complete spinal block. On analysis, protein and globulin were greatly increased.

Diagnosis.—Cauda equina tumour.

Operation, 30.5.33. Laminectomy.—The dura was tense and bluish. There was no pulsation until as high as the twelfth dorsal laminæ had been removed. The contents of the dura felt hard. Dura opened. Small quantity of yellow fluid escaped. The whole of the exposed canal was tightly packed with soft tumour. This was thinly encapsulated and appeared to have originated from the conus and grown downwards, pushing the components of the cauda to the periphery. As much as possible was removed by dissection and suction. Condition during operation remained good.

31.5.33.—Fairly free from pain. Good condition.

14.6.33.—Has put on weight. Sleeps much better. Is free from pain. Can now move the feet. Passive movements painless. Sensations returning. Still incontinent.

Pathological diagnosis.—Ependymoma.

POSTSCRIPT (22.9.33).—The private doctor reports that the child is now walking.

Tuberculoma of the Occipital Lobe: Removal: Recovery.—F. A. R. STAMMERS, F.R.C.S.

J. A., a boy aged 11 years, admitted March, 1930, complaining of headache and vomiting.

History.—Eighteen months previously he had been knocked down in the street and rendered unconscious, and was detained in another hospital for three weeks. He appeared to be in a satisfactory condition until two months previously, when he complained of headache in the right occipital region, giddiness, and occasional vomiting. On examination in the out-patient department nothing abnormal was found, apart from a marked squint which had been present from infancy. The case was thought to be one of post-traumatic headache.

On examination.—Nothing abnormal found except the discs, which showed an optic neuritis of 2 D. It was not possible to get the boy to co-operate for obtaining visual fields.

The diagnosis was therefore changed to one of intracranial tumour or abscess, and it was decided to perform ventriculography in order to endeavour to localize the site of the lesion. As the needle was passed through a trephine hole towards the posterior horn of the right lateral ventricle it was felt to encounter a hard tumour.

Operation.—Parieto-occipital bone-flap. The tumour was about 1 cm. deep to the surface of the occipital lobe. It was removed, and owing to the marked intracranial pressure it was necessary to sacrifice the bone. A blood transfusion was given.

Progress.—Very satisfactory. One year later bone-grafting was performed, ribs being used for the graft.

Comment.—Had this boy been old enough to co-operate it is almost certain that he would have shown some homonymous field defect—probably lower quadrantic in type.

Severe Epilepsy, completely alleviated by Encephalography.—J. M. SMELLIE, M.D.

Kenneth P., a boy, aged 7 years, was first seen in February 1932, with a history of frequent convulsions commencing only a few weeks previously. On admission to hospital the convulsions were of the "petit mal" type and so frequent that a diagnosis of pyknolepsy was suggested.

Examination of the central nervous system was negative and under bromides and luminal the attacks were reduced considerably in frequency, and the boy was discharged from hospital.

He was readmitted a month later as the fits had again become frequent and more severe. Further examination of the nervous system, biochemical investigation of the cerebrospinal fluid and Wassermann reactions were all negative.

On April 15, 1932, 55 c.c. of cerebrospinal fluid were removed by lumbar puncture and 40 c.c. of air introduced. A skiagram examination taken immediately afterwards showed a normal filling of all ventricles.

The boy was discharged from hospital about a week later and has remained perfectly well since then. There have been no fits, although he now appears to be somewhat mentally defective.

Severe Epileptiform Convulsions: Considerable Improvement following Encephalography.—J. M. SMELLIE, M.D.

William M., aged 5 years, had frequent convulsive attacks beginning early in 1932. These became rapidly more frequent and longer in duration until July 1932.

Operation (July 1932): Lumbar puncture; 60 c.c. of cerebrospinal fluid withdrawn and 48 c.c. of air introduced.

Following encephalography there were no fits for three weeks; then fits occurred much less frequently than before and the attacks were less severe.

High Basal Metabolic Rate: Exophthalmic Goitre.—J. M. SMELLIE, M.D.

Edna C., aged 12½ years was first seen in March 1932 with a history of having had attacks of fainting at school for about two months. A swelling in the neck had been noticed for two or three weeks, and there had been sweating for a similar period. The child even at that time presented the obvious appearance of exophthalmic goitre.

The basal metabolic rate showed that she was 44% above the statistical mean normal for a child of her size. She was kept in hospital for many months and given a variation of treatment, including Lugol's iodine, insulin and glucose, etc.

Her pulse-rate remained steady, between 120 and 140, and though at first there was a loss of about one pound in weight, during the remaining period her weight was stationary. In August 1932 acute tonsillitis developed, followed by an acute nephritis, and in December 1932 the tonsils were removed.

Her general condition since then has remained good, and though she still has tachycardia, enlarged thyroid and tremors, there has been no further loss of weight.

She is now attending hospital as an out-patient, once a week, for X-ray treatment.

Ankylosis of the Temporo-maxillary Joint, following Diphtheria and Otorrhœa.—J. M. SMELLIE, M.D.

Irene W., aged 5½ years, had diphtheria in November 1930. She was quite well on discharge from the fever hospital, except for left otorrhœa. Two months later, i.e., in April, 1931, she began to have difficulty in opening her mouth. Eleven months later she was first seen in the out-patient department; her mouth could then only be opened to a very slight extent, and she still had a discharging left ear. X-ray examination showed an ankylosis of the left temporo-maxillary joint.

She was admitted to hospital in March 1932, and examination under an anæsthetic confirmed the X-ray picture of ankylosis; the vertical jaw movement was about a quarter of an inch, the lateral movement to the right also a quarter of an inch, and there was no travel to the left.

As the otorrhœa failed to respond to treatment, operation was performed in June 1932, when the left mastoid antrum was opened. Since then the ear has continued to discharge, in spite of intensive treatment.

Now the mouth can be opened less than a quarter of an inch, but the child's nutrition is maintained to a remarkable extent, in spite of the difficulty in feeding.

Question of surgical treatment of the joint has been considered but has been delayed on account of the sepsis in the ear.

Cutaneous Xanthomata associated with Intermittent Diabetes Insipidus. (High blood-fat and normal blood-cholesterol.)—B. C. TATE, M.B.

M. D., a female infant, aged 2 years. Youngest child in family of four; other members of family are healthy.

Admitted to hospital January, 1933, aged 1 year and 7 months, with a seven month's history of excessive thirst and polyuria. Small tumours of the skin had appeared during the same period, but their exact duration was unknown. She had been examined previously in another hospital and a diagnosis of diabetes insipidus had been made.

Physical examination.—There were signs of previous rickets, but apart from these and the skin condition there were no other abnormal physical signs. Weight 1 st. 3 lb. Urine: specific gravity 1018; acid; no abnormal contents.

Skin.—The skin of the face showed a diffuse yellowish mottling, which on close examination was seen to be caused by a large number of very slightly raised yellowish papules. In addition there was a smooth, yellow tumour about 2 mm. in diameter above the left eyebrow, another on the right frontal region just inside the hair margin, and another about 3 mm. diameter on the left thigh. These appeared to be typical xanthomata. Sections of the tumour from the thigh showed areas of infiltration in the dermis, consisting of typical xanthoma cells together with fibroblasts and a few small lymphocytes.

In hospital the excessive thirst and polyuria disappeared.

Blood-cholesterol 180 mgm.%; blood-fat 770 mgm.%; glucose tolerance curve, normal. Skiagrams of skull and long bones normal.

Comment.—This case appears to be one of lipoid infiltration, comparable to the Schüller-Christian syndrome. The nature of the lipoid present in the skin tumours has not yet been investigated. The normal value of the blood-cholesterol does not exclude a cholesterol infiltration, for it is probable that an alteration of the proportions of the various fractions of the lipoid system is of greater importance than an absolute increase of any one constituent.

Dr. PARKES WEBER agreed that the case might well be an atypical and incomplete example of so-called lipoid-granulomatosis or xanthomatosis (the "Hand-Schüller-Christian disease"), in spite of the absence of exophthalmos. The diabetes insipidus may have been due to local lipoid-granulomatosis of the pituitary gland region, though no radiographic abnormality of the sella turcica was discovered. Perhaps the absence of hypercholesterolæmia corresponded to a period when the diabetes insipidus was disappearing. Professor H. Rietschel (*Zeitschrift für Kinderheilk.*, 1932, liv, p. 78) had recently suggested that a case formerly described by F. P. Weber and H. Schmidt, in which the xanthomatosis was limited to the region of the pituitary gland, should be regarded as an incomplete example of lipoid-granulomatosis. In that case there had been diabetes insipidus, but negative radiographic sella turcica findings. The distribution of the spots on the face in Dr. Tate's case was rather more like that of Pringle's type of sebaceous adenomata than of a xanthomatous eruption.

Section of Dermatology.

President—A. M. H. Gray, C.B.E., M.D.

[*June* 15, 1933.]

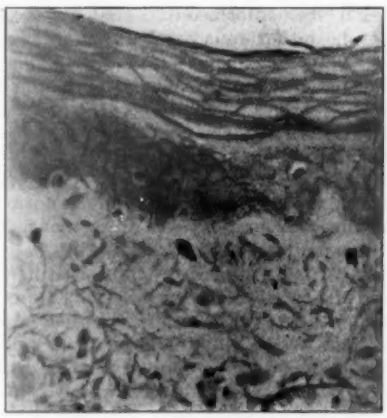
Telangiectasia (Stellate Nævi) with Elastic Dystrophy.—Robert Klaber, M.D.

J. J., a schoolgirl, aged 15, came to St. Bartholomew's Hospital because the school doctor had noticed yellow spots on her calves. They caused no subjective symptoms, and were thought to have been present since an attack of measles two years ago.

On the back of the right calf was a single macule, 1½ cm. in diameter, and three smaller macules, in line, were on the back of the left calf. These macules were of orange-yellow colour, and showed a well defined circular margin, which contrasted with a cyanotic background when the patient was standing. In the centre of each was a small telangiectasis; other telangiectases, suggesting "stellate nævi," have since been observed in the regions of knees and wrists.

On palpation, only the central vascular point was slightly raised, but there seemed to be some diminution of normal elasticity. The girl is well, except for muscular rheumatism and occasional epistaxis.

There is no family history of any similar condition.



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(Weigert's elastic stain). Sub-epithelial collastin clumps.
(*Photomicrograph by Dr. Robb-Smith.*)

Histological report.—Material for biopsy was obtained from the largest macule, on the right leg. An unstained section showed well-marked epithelial pigmentation and irregular rarefaction of the corium. Hæmatoxylin and eosin staining showed nothing additional. Weigert's elastic stain showed some irregularity in the form, staining, and distribution of elastic tissue throughout the corium. More definite

changes, however, were present in the pars papillaris, where the elastic fibres showed an irregular distribution, their dendrites in some areas, appeared to terminate in irregular, small rounded masses of collastin lying just below the basal epithelium.

Comment.—In spite of the superficial resemblance of this case to some of those described as atypical examples of Darier's pseudo-xanthoma elasticum, it seems, both on clinical and histological grounds, to fall outside that group.

It appears to be an example of telangiectasia associated with a peculiar form of elastic dystrophy. The yellow colour is probably due to a lipochrome associated with the elastic dystrophy.

Though showing less advanced histological lesions, the case is perhaps related to a recent case of Pautrier's [1] described as "telangiectasies angiomateuses, atrophiques, cicatricielles."

It is tempting to speculate on the relationship of the elastic changes to the telangiectases. Is it possible that the latter are secondary to elastic degeneration, as in the case of Morgan's spots? Or is the degeneration secondary, and the telangiectasis the result of other factors, which might possibly include "back pressure" from her perniotic circulation?

? Lichen Plano-pilaris. Case for Diagnosis.—H. W. BARBER, M.B.

Mr. A. T. M., aged 60, first consulted me in October, 1932, on account of a pruriginous affection of the skin, of three years' duration. It began as a single patch on the right leg. He had already consulted another dermatologist, who considered, I think with good reason, that the condition was a psychogenic pruritus.

The patient was a prisoner of war in Germany for four years. In 1922 he was operated upon by Mr. A. R. Thompson for what was considered to be a malignant prostate. Mr. Thompson has informed me that the pathologist's report stated that the prostate might be either inflammatory or malignant, but, if the latter, it was not infiltrating.

When I first saw the patient there was a general thickening with lichenification of the skin, associated with rather indefinite erythematous patches, and superficial scaliness in some areas, e.g., the upper arms. There were palpable glands in the groins, axillæ, and neck. He complained of paroxysms of itching at night, but on the whole he slept well.

Blood-pressure 140. Urine normal. Blood-count normal.

I did not think that the eruption was entirely a neurodermatitis, and considered the possibilities of mycosis fungoides and leukæmia.

I suggested a course of peptone injections, but this was interrupted by the appearance of boils, and abscesses in the right axilla and thigh. In March, 1933, after ten injections of peptone, the appearance of the eruption had changed, being then lichenoid in type, and over the deltoids were scaly patches enclosing islets of normal skin, such as are seen in a premycosic erythrodermia.

In May the eruption had altered still further, and consisted chiefly of follicular papules, with, below the knees, definite horny follicular plugs.

On June 2 I came to the conclusion that the condition was a somewhat atypical lichen plano-pilaris; some lesions were plane follicular papules, others resembled those of lichen nitidus, whereas in some areas there were palpable horny plugs of the lichen spinulosus type. The buccal mucous membrane is unaffected.

I do not think that anyone, seeing the patient at the time of his first visit to me, would have considered the diagnosis of lichen planus at all.

[1] Pautrier, *Acta. Derma. Venereologica*, 1932, xiii, 347.

Bilateral Thoracic Zosteroid Spreading Marginate Telangiectasia—probably a Variety of "Carcinoma Erysipelatodes" (C. Rasch)—associated with Unilateral Mammary Carcinoma, and better termed "Carcinoma Telangiectaticum."—F. PARKES WEBER, M.D.

The patient, Mrs. E. T., aged 48 years, is a married Englishwoman of medium size and general nutrition. In October, 1932, her left mamma was amputated for carcinoma and the axilla was cleared out. At the time of the operation there was a curious telangiectatic condition of the skin over the mamma, and a small area of skin in the left axilla had a similar appearance. Almost all of the telangiectatic skin was removed together with the carcinomatous mamma. Since the operation the telangiectatic process, which in most parts shows a very definite spreading margin, has extended, so as to involve a great portion of the skin on the front and back of the left half of the thorax, and has also involved a large area of skin over the right mamma and part of the right front of the chest. On the left side the operation scars are especially affected. In some parts the process spreads by the formation of small telangiectatic islets. The telangiectatic margins and islets are somewhat raised above the general level of the skin.

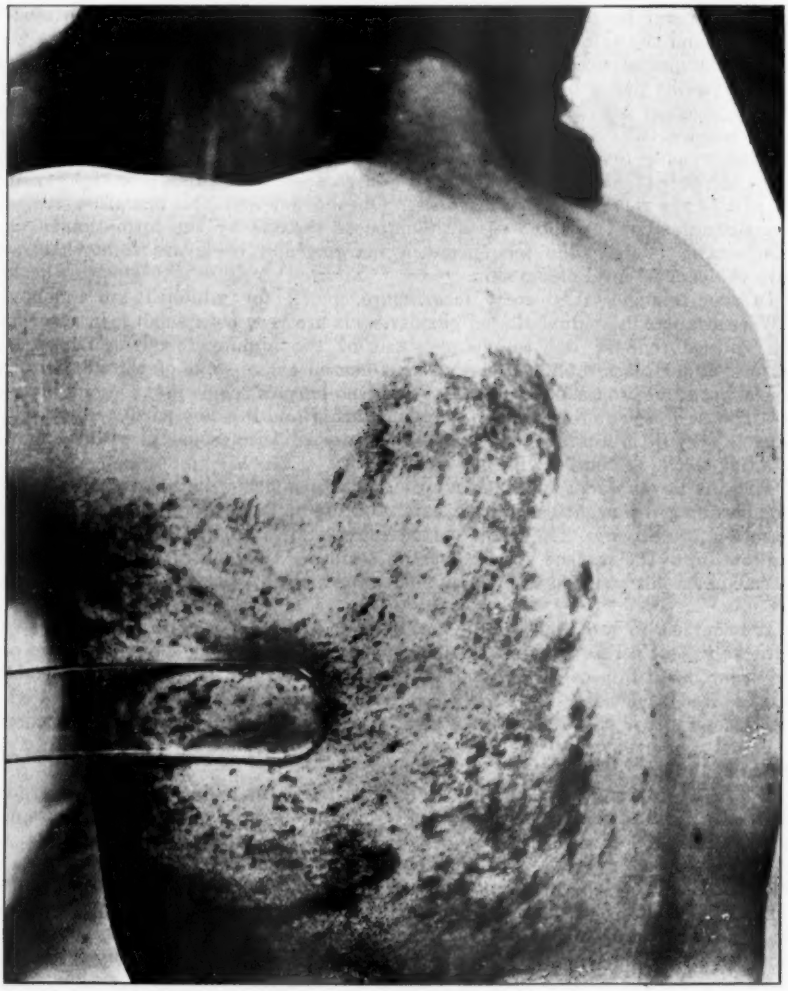
In the telangiectatic areas (see figure, p. 72, for which I am indebted to Dr. Weisswange) individual dilated blood-vessels are very conspicuous, in association with diffuse redness due to telangiectasis of the minute blood-capillaries. By pressure under glass the blood cannot be squeezed out of some of the dilated blood-vessels, but there are no blood-extravasations (no purpuric elements) present. In some parts the skin shows a little brown pigmentation and in some parts a slight glossy change. Very little itching or paræsthesia of any kind is associated with the trouble, according to the patient.

There is no apparent enlargement of axillary or other lymphatic glands. The blood-serum gives negative Wassermann and Meinicke reactions. Brachial blood-pressure: 155/80 mm. Hg. The blood-count shows slight anæmia. Otherwise examination of the patient shows nothing abnormal. Menstruation is still regular. She has never been treated with X-rays—for the mammary carcinoma or for anything else.

It occurred to me that in this patient the zosteroid (zoniform) telangiectasia might represent a rare atypical variety of morphœa in which there was little or no true sclerodermatous change present, but in which the cutaneous telangiectatic change, often associated with morphœic sclerodermia, was greatly exaggerated. I have recently read the account of a case in which a thoracic zosteroid sclerodermia developed a month after the incision of an axillary abscess (abstract in *Presse Médicale*, 1933, xli, 610).

But, after talking with Dr. H. W. Barber, it seems to me much more probable that the condition in the present case is a variety of the very rare "carcinoma erysipelatodes" described by C. Rasch (*Brit. Journ. Derm. and Syph.*, 1931, xliii, 351), which Rasch says was first described by Hermann Küttner of Breslau in 1924, under the title "erysipelas carcinomatosum" (Bruns' *Beiträge zur klin. Chir.*, 1924, cxxxi, 7). Küttner differentiated "erysipelas carcinomatosum" clinically and histologically from "cancer en cuirasse," the former spreading by the (superficial) blood-vessels, whilst the latter spreads by the lymphatics and the connective tissue spaces, and produces very marked scleroderma-like hardening of the skin. Rasch points out that a characteristic of erysipelatoid carcinoma is that it grows sub-epidermally within the underlying blood-vessels without attacking the epidermis, whilst Paget's disease grows within the epidermis. In the present case I have little doubt that the reason why the blood cannot be squeezed out of some of the telangiectases is that some of the minute blood-vessels have their lumen blocked by cancer cells. A biopsy will doubtless settle the diagnosis.

I have little doubt that in the present case the telangiectatic cancerous condition is spreading mainly, if not entirely, in the lumen of the blood-capillaries of the skin, though the lymphatics and connective tissue spaces may likewise in some parts be involved. H. W. Barber's case (*Proceedings*, 1931-1932, xxv, 670, Sect. Derm. 28)



The telangiectatic skin on the left side of the back partly under pressure with a glass spatula.

seems to have been a mixture of the condition seen in the present patient, with "cancer en cuirasse" and "Paget's disease," and I expect that the association of two, or all three, of these carcinomatous processes in the skin will be occasionally observed in the future.

Microscopical examination.—A piece of skin from the margin of the telangiectatic region was excised by Mr. H. Rast on June 19. Microscopical sections showed enormous dilatation of the cutaneous blood-capillaries, which contained clumps of cancer cells, and here and there a little blood.

Activity in the cancer cells was evidenced by the presence of several mitotic figures, but the central portions of some of the clumps were necrotic. It is possible that some of the vessels containing cancer cells, but in which no blood was seen, were lymph-capillaries. There was very little evidence of inflammatory reaction.

As there was clinically in the present case no real resemblance to erysipelas, I propose to call the condition "carcinoma telangiectaticum," which would of course include "carcinoma erysipelatodes."

Discussion.—Dr. HUGH GORDON said that about a year previously he had shown a case in which the condition looked almost identical with this.[1] The patient was a woman who had had a breast removed for carcinoma and had subsequently developed an eruption consisting of small hard papules in the skin arranged in finger-like strands spreading over the chest wall. Microscopic section showed both lymph spaces and capillaries packed with carcinoma cells. She had died recently with a tremendous lymphatic œdema of the arm.

Sir ERNEST GRAHAM-LITTLE said that another correction of the nomenclature might be made. In this case there were definite carcinomatous nodules, and he thought this was a rare instance of miliary carcinoma. He remembered a remarkably similar case, that of a woman, aged 45, who had scirrhus of one breast. She was seen by several surgeons. Mr. Clutton gave her nine months to live, Mr. Marmaduke Sheilds gave her eighteen months. She refused the suggested removal of the breast, and she lived twenty-eight years after. The scirrhous breast was displaced by fibrosis, but twenty years later she was seen again with a formidable carcinomatosis of the skin and deeper tissues, and died eight years later. The present case he regarded as similar, and he did not think anything would check the progress of the condition.

The PRESIDENT said that a point difficult of explanation if one assumed that this was a purely blood-vessel involvement, was the peculiar distribution which suggested that there was at least a lymphatic element in it. When examining cases of this kind one always found the blood-vessels filled with carcinomatous cells, even though lymphatics also were involved. Examination of a microscopic section would solve the point. Clinically, it seemed to be a case in which the blood-vessels were mainly affected.

ADDENDUM (*August*, 1933).—Superficial X-ray treatment is at present cautiously being tried at University College Hospital.—(F. P. W.).

Congenital Hypotrichosis in a Child.—F. PARKES WEBER, M.D.

The patient, J. N., an English girl, aged 3 years, has very little hair and a roughness of the skin of the scalp, and has likewise scanty hair on her eyebrows. She was apparently born without any hair on scalp or eyebrows, but since birth a certain growth of hair in these situations has occurred. The scanty scalp hair often disappears and reappears—a "flickering" growth, if one be permitted to use that expression. There is no general ichthyotic condition of the skin, nor any defect in regard to nails, teeth or sweat-apparatus. The child's forehead bulges somewhat and the skull is slightly asymmetrical, but there is no decided evidence of rachitis. The tonsils are large and there is slight enlargement of cervical lymph-glands.

I regard the condition of the scalp as a mild congenital-developmental ectodermal abnormality, but there is no history of any similar abnormality in the family. The

1 *Proceedings*, 1932, xxv, 1551 (Sect. Derm. 83).

Congenital hypotrichosis in a child aged 3 years.

patient is an only child. Her mother has had no miscarriages. The blood-serum of both parents gives negative Wassermann and Meinicke reactions. There is no consanguinity between the parents.

Discussion.—Dr. J. T. INGRAM asked whether the exhibitor thought it worth while to epilate with X-rays. The case must, he thought, be related to moniliform dystrophies. He had one case of monilethrix in which he had carried out epilation three times, the third time twenty-one months ago, and there was now little dystrophy remaining except round the hair margins. The first time it relapsed in six months, the next time not until after twelve months. The epilation seemed to have some stabilising effect on the subsequent growth for a period. In the present case, if the dystrophy was not of the degree which produced monilethrix, X-ray epilation might be more effective still.

Dr. C. H. WHITTLE said that at the meeting of the British Association of Dermatology and Syphilology held in July, 1932, he had shown a case of what he described as alopecia in a child. He had treated that case successfully with ultra-violet light.

Two cases of alopecia had been shown at a meeting of the Section in June, 1932,[1] and in both of these the patients recovered without ultra-violet irradiation. He did not regard the outlook as serious.

Dr. PARKES WEBER (in reply) said that, as there was just a chance of the ultimate occurrence of a spontaneous moderate growth of hair on the child's scalp, he thought it advisable not to employ X-rays on the chance that complete depilation by X-rays might be followed by better growth of hair.

1 *Proceedings*, 1932, xxv, 1741-2 (Sect. Derm., 87, 88).

Pityriasis Lichenoides et Varioliformis Acuta.—H. MACCORMAC, C.B.E., M.D.

The patient, a man aged 29, who has only recently been seen at the Middlesex Hospital, gives the following history:—

About eight weeks ago he first noticed the eruption, which is itchy, and is distributed over the trunk, arms, and legs. In its general form it is polymorphous, consisting of slightly raised irregular small lichenoid papules, and of a number of other lesions in which definite necrosis has taken place, forming small crusts.

This condition appears to conform to the acute type of parapsoriasis, and in many respects resembles that shown in the plate illustrating Viktor Mucha's case, except that the lesions are not so numerous.

A somewhat similar case at present under observation at Middlesex Hospital has responded well to injections of sodium morrhuate and intensive ultra-violet light treatment. This may have no bearing on the nature of the condition, but it hints that this form of parapsoriasis may possibly belong to the tuberculide group.

Arsenical Keratoses: Multiple Basal-Cell Carcinomata and Arsenical "Warts."—H. MACCORMAC, C.B.E., M.D.

Miss W., aged 51, has been recently under treatment for carcinoma of the cervix at the Middlesex Hospital where the condition now present on her skin was observed. On questioning her it was ascertained that about twenty-five years ago she took "medicine" for asthma for approximately two years; it may be assumed that this "medicine" contained arsenic.

She shows three separate eruptive processes: (1) multiple punctate discrete keratoses of the palms and soles; (2) multiple superficial erythematoid new growths on the trunk of the superficial rodent ulcer type, and (3) on the arms and also on the wrists and abdomen, raised crusted warty nodules which are pre-malignant or actually malignant. As she was seen by me only yesterday for the first time it has not been possible to investigate the microscopic structure of these lesions.

It would seem that they may all be attributed to arsenic, although no pigmentation is present. The late Dr. Pringle first called my attention to the association of psoriasis with multiple superficial rodent ulcers in cases in which prolonged arsenical treatment for psoriasis had been carried out.

Dr. H. W. BARBER said that the question whether the taking of arsenic might predispose to the subsequent development of multiple basal-celled epitheliomata was one that had given rise to considerable discussion in recent years. Some time ago he had seen a patient with multiple basal-celled epitheliomata of the superficial type. This patient had had dermatitis herpetiformis twenty years previously, and had taken arsenic over a long period in large doses.

Localized Pemphigus.—A. C. ROXBURGH, M.D., and H. CORSI, F.R.C.S.

Patient, male, aged 36.

Two areas are affected: (1) right temple, circular plaque, 4 inches in diameter, since April, 1932. Scalp, on right side near vertex, similar plaque, 2 inches in diameter, since November, 1932.

April, 1932.—Patch of red blotches on which crusts developed.

June, 1932.—Small blisters appeared quite suddenly in the night all over the area. No pain, but irritation preceded the eruption of the blisters. The blisters healed quickly, but others developed continuously, showing a tendency to become larger and fewer.

September, October and November, 1932, in Salford Hospital, under Dr. Marianne Peach. Nine weekly treatments of X-rays. Became perfectly well except that there was no hair on that part of the temple where, normally, hair is present.

Ten days after the last treatment there was a relapse, and in addition the patch on the scalp appeared. Since then the process has persisted. Arsenic was administered for a month, 3 to 6 minims t.d.s., without effect. Mercury, quinine, potassium iodide and a stock staphylococcal vaccine did not influence the condition.

Now (June, 1933) the areas are slightly erythematous and there is possibly some atrophy. Bullæ appear from day to day; when artificially broken, they are

Localized pemphigus.

seen to contain a clear serous fluid. Here and there are bits of dead epidermis, and some crusts and desquamation. In many places the epidermis can be made to slide. There are no general symptoms. General examination normal. The blood shows 4% eosinophils in a white cell count of 6,400. Otherwise it is normal.

The upper part of the temple lesion was covered with strapping for five days (removed yesterday) and the condition became worse.

A section shows that the roof of the bulla consists of the whole thickness of the epidermis.

Discussion.—Dr. H. W. BARBER said he thought this was a typical example of the so-called Senear-Usher syndrome. Some time ago he had shown a case of it in a woman; the eruption on the scalp was more extensive than that in this case, and was also present on the neck; the buccal mucous membrane and conjunctivæ were also involved, as in true pemphigus, and there was essential shrinking of the conjunctiva. He did not think the condition corresponded with that in the cases of so-called localized pemphigus described by the older dermatologists. A striking feature about these cases was the atrophy, like that of lupus erythematosus, which took place in the affected areas, and the bullæ continued to form on the atrophic areas. Judging from his own case, the condition was more like pemphigus than lupus erythematosus, owing to the involvement of the buccal mucous membrane and the conjunctiva. His patient was still alive; her condition varied. He took her into hospital for a time and she improved, but after her discharge the condition became as bad as ever.

Dr. G. B. DOWLING said that a few years ago he had shown an almost similar case[1]; the only difference was that the lesion was on the other side of the face. There was the same erythematous inflammatory change and there was the same type of bullæ, more towards the periphery of the area than in the centre. At the time, he suggested that the condition might be a localized variety of bullous lupus erythematosus, but the President pointed out the absence of follicular plugging and scaling normally associated with lupus erythematosus. At his (the speaker's) suggestion the patient was given a course of gold treatment by his own doctor, but there had been no improvement. The only justification which could be found for calling the present case one of pemphigus, was the existence of bullæ. Neither could the condition be reasonably diagnosed as lupus erythematosus. He thought that this was probably a disease *sui generis*, of which we had, so far, seen very few examples.

Dr. J. T. INGRAM said that Wise had written two or three papers on this subject, in which he had insisted that there was much confusion between cases which seemed to be true bullous lupus erythematosus, and the Senear-Usher group of cases, which were more a combination of the pemphigus type of eruption (rather like pemphigus foliaceus, characterized by bullæ arising on normal skin), with a seborrhœic type of dermatitis, often having the characters of lupus erythematosus, but with seborrhœic dermatitis round the eyes, trunk and back; a condition in which scarring did not supervene.

He (the speaker) had had two cases of Senear-Usher type, one of which he had described in the *British Journal of Dermatology*,[2] in which the condition was very benign and did not lead to scarring; it seemed to be allied to pemphigus foliaceus, but had this seborrhœic dermatitis associated with it.

When first he saw the present case he thought the lesion was an artefact, because of the right-sided character of the eruption, the absence of reflexes, and the facies. Alternatively, he thought it might be lupus erythematosus, because of the persistent erythema, the distribution, and the fact that the bullæ arose on erythema and not on normal skin. The use of the term "pemphigus" seemed unhappy in relation to these cases.

Dr. A. C. ROXBURGH (in reply) said that his colleague and himself had also considered the possibility of the lesion being an artefact, and accordingly they had covered up the part with zinc-oxide strapping for three days. It had previously been strapped in Manchester; there was no improvement on either occasion.

Dr. CORSI (in reply) said that he would join issue on the nomenclature even more strongly than others had done. It had been said that the only reason for applying the term "pemphigus" was that bullæ were arising on normal skin. They did not, however, arise on normal skin, but on erythematous skin. For this reason, although the epidermis could be made to slide over the underlying corium, he and his colleague had particularly avoided using the term Nikolsky's sign, which they thought should be used only where bullæ could be produced on apparently normal skin. Thus in this case the term "pemphigus" was quite wrong, but had been used to bring the case into relation with previous articles on the subject.

Ichthyosis Histrix. (Familial.)—ARTHUR BURROWS, M.D. (for Dr. W. J. O'DONOVAN).

Patricia R., aged 6, when born, had "swollen-looking" hands and feet, with thick skin of the palms and soles. The thickened condition has spread up the legs and arms. When first seen the lesions were brown or black in colour, and the condition of the palms of the hands and soles of the feet suggested tylosis, but the rough linear arrangement of the lesions of the limbs was quite obvious. There is a small thickened papillated patch over the lower end of the sacrum. No obvious spina bifida is present. With care and cleaning in hospital, the lesions became nearly the same colour as the skin, as at present, and the thickening of the palms of the hands and the soles of the feet was much diminished, assuming the obvious linear streaked form which is now seen on the palms and soles.

No attempt at radical treatment has been made.

[1] *Proceedings*, 1929-30, xxiii, 413 (Sect. Derm., 11).
[2] 1932, xliv, 233.

The child is the youngest of a family of eight. The skin of both her father and her mother is quite clear, and no skin defect is known in any other members of the family, grandparents or further back. There is no blood-relationship between the parents. One sister, now aged 20, suffering from a pronounced ichthyosis histrix, was a patient of Dr. Sequeira fifteen years ago, and is now apparently attending another hospital in London. No other brothers or sisters are affected.

Fox-Fordyce Disease.—NORMAN BURGESS, M.D.

Miss I. F., aged 30 years, five years ago had an operation for removal of gall-stones, and two years ago had an ovarian cyst removed. Shortly after this an itching eruption appeared in the axillæ and later spread to the breasts and the pubic region. The itching is intense at times, especially at night.

The eruption consists of follicular papules which are present in both axillæ, on the lateral sides of both breasts, and in the pubic region. The papules are, for the most part, about the size of a pin-head, and their colour is that of the surrounding skin. The lesions are smooth, firm and rounded, and the surrounding skin is somewhat lichenified ; the papules do not disappear on pressure.

Report on Microscopic Examination of Skin (Dr. A. L. Taylor).

(1) Cross section. The epidermis is somewhat thickened and irregular, with, at intervals, crypts containing horny debris. No mouths of sweat ducts are included in the section, but in the corium at one place there is a collection of deep ducts and one or two hair follicles. Note the characteristic round-cell infiltration around the ducts, the hair follicles remaining relatively free. There is some increase in fibrous tissue in the superficial layer of the corium, suggesting that contraction of this may have given rise to the puckering of the epidermis and consequent crypt formation.

(2) Tangential section through one of the papules. The interpapillary pegs are accentuated and lie deeply in the corium, and the horny plugs in the centre of each are well shown.

This condition was first described by G. H. Fox and J. A. Fordyce in 1902, and since that time about 80 cases have been described. Fordyce gives the following description of the histology of the condition : (1) Hyperkeratosis of sweat-duct orifices, their intra-epidermic portions and orifices of the hair follicles ; (2) mechanical dilatation of coil gland, which results in changes in the epithelial lining ; (3) acanthosis surrounding altered sweat ducts and hair follicles : (4) inflammatory changes of more or less chronic character in the derma ; (5) some parakeratosis, papillary hypertrophy and œdema, with perivascular lymphocytic infiltration.

It has been pointed out that the situation of the lesions corresponds to the site of the apocrine glands of Schieffedecker. These glands are said to be secondary sex-characteristics, and are more numerous in women than in men, only two cases of the disease having been reported in males. The apocrine glands are said to be more numerous in Jewesses than in women of other races, and the Fox-Fordyce syndrome is also said to be commoner in Jewesses.

The ætiology of the disease is unknown, but in this case there seems to be a definite association between the removal of the ovarian cyst and the development of the disease.

Although a good result from X-ray treatment has been reported by Brown, the general opinion seems to be that X-ray treatment is of little value in these cases.

In a case which I saw in Schamberg's Clinic, the application of 25% followed by that of dilute acetic acid was suggested, but I do not know what result was obtained.

Discussion.—The PRESIDENT said this was a typical case of the condition. He thought the best treatment was by means of X-rays, but these had to be given in larger doses than were necessary for simple pruritic conditions. He treated these cases in the same way as he would treat a case of hyperidrosis.

Dr. DOWLING said that he had shown at a meeting of the Section a woman, aged about 40, whom he had treated, without success, with theelin.[1]

Pigmentation of Oral Mucosa: Case for Diagnosis. — W. N. GOLDSMITH, M.D.

C. E., female, aged 68, has had brown spots on the lips and oral mucosa for about three years. These are increasing in number and during the past week similar patches have been noticed on the tips of the fingers.

The spots are a peculiar muddy, grey-brown colour, irregular in shape and not infiltrated; they involve the lips, palate, cheeks, and finger tips.

There are ordinary freckles, not very marked, on the chin and the upper part of the chest. I wondered whether the lesions might possibly be malignant melanomata, but on the whole I do not think so.

Discussion.—Dr. J. T. INGRAM said that this patient said that she had had a general loss of vitality during the last few months, and said that since January she had not been able to do her ordinary work so well. It was therefore possible that the case was a manifestation of the Addisonian type of disturbance of the suprarenals.

Dr. I. MUENDE said that the case was worth a more fully detailed investigation. He had a case in a girl aged 14 who, since the onset of puberty, had had melanotic nævi on her arms and legs. Her blood-pressure was 130, and recently she had complained of nervousness and listlessness. He had found a heavy deposit of pigment in the urine, which he thought would turn out to be a melanogen; it reduced copper, and then became jet black.

ADDENDUM.—Dr. MUENDE reports that histologically there is evidence of increased formation of melanin, but there are no nævus cells and no signs of malignancy. There is no evidence of Addison's disease. [W. N. G.]

Pseudo-Elephantiasis of the Hands.—Sir ALDO CASTELLANI, K.C.M.G. (Hon.), M.D.

A. B., male, aged 48, enlisted early in 1915 and was sent to India, where he contracted malaria very soon after arrival. He was then in Iraq from late 1916 to early 1919, during which time he had four mild attacks of fever. He was discharged in April, 1919, and first noticed the œdema of the wrists three months later, but as it was not painful in any way, no attention was paid to it. This was followed by slight dermatitis of the dorsum of the hand.

During the period 1919-1929 the patient had several further attacks of fever, and the swelling gradually spread up the arm.

In December, 1931, inflammation of both arms suddenly developed, with a temperature of 104° F. and a degree of coma. The right arm was drained above the elbow and the left on the dorsum of the hand. Soon afterwards there was another inflammatory attack and the swelling has persisted ever since, being slightly worse at some times than at others.

Urine.—No albumin, casts or sugar.

Blood.—Wassermann reaction negative; no filaria; no malaria parasites.

Discussion.—The PRESIDENT asked to what Sir Aldo attributed the condition.

Sir ALDO CASTELLANI (in reply) said that he considered the cause to be some local bacterial infection, and for that reason he named it non-filarial elephantiasis "pseudo-elephantiasis." In several cases of a somewhat similar nature he had found cocci of the myceticus-metamyceticus.

[1] *Proceedings*, 1932, xxv, 1031 (Sect. Derm., 55).

Tinea Imbricata (Case showing great Improvement).—Sir ALDO CASTELLANI, K.C.M.G. (Hon.), M.D.

This case was shown at the meeting held on October 20, 1932.[1] I am showing it again in order to emphasize how difficult is the treatment of this disease. The patient contracted tinea imbricata seventeen or eighteen years ago, and has had many different kinds of treatment, including X-rays, radium, and various kinds of light treatment, but without benefit. Six months ago I began to treat him with the fuchsin-acetone resorcin-boric acid paint, which I introduced some years ago for the treatment of epidermophytosis, and the result may be considered fairly satisfactory.

Mycosis Fungoides (Granuloma Fungoides).—C. H. WHITTLE, M.D.

D. C., a man aged 67.

History.—Five years ago a tumour developed over the insertion of the left deltoid; this was painless until it became excoriated. About the same time the patient noticed discoloured patches and plaques on the skin of the trunk and upper part of the limbs. The tumour on the left shoulder ulcerated and was excised by the surgeon in charge of the case. The pathological report noted the large amount of granulation tissue, but suggested, on account of some rather atypical hyperplasia of squamous epithelium, that it might be a rodent ulcer. The plaques and discoloured patches on the skin were noted by the surgeon as psoriasis.

A second biopsy made a year later for a recurrence showed masses of granulation tissue.

I was asked to see the patient on March 17, 1933, and suggested that the diagnosis rested between Hodgkin's lymphogranuloma of the skin and mycosis fungoides. I thought the latter the more likely, since there was not very widespread nor very marked glandular enlargement.

Present condition.—The granular, tomato-like swelling over the left shoulder has now dwindled under X-ray treatment, and there is little left but a healing area of healthy-looking granulation tissue.

The lesions elsewhere include: (1) Mauve-brown sheets extending over large areas of the back and front of the trunk. These sheets have in places a definitely infiltrated character and an edge raised above the healthy skin. (2) Circular scaly plaques over the left buttock much like psoriasis in appearance, but, in my opinion, definitely infiltrated. In one of these there is a firm nodule involving the true skin. (3) Granulomatous tumours of the left arm, around which there is thickened scar tissue. (4) Areas of brownish discoloration over the arms and trunk, in which there is no infiltration and wrinkling and scaling of the epidermis. In these patches, which are sharply circumscribed like the other patches, the disease appears to be dying down. (5) White papery scars on the trunk.

The Kahn reaction is negative.

The patient is married and has three healthy children. His wife has had no miscarriages.

The histological section is not very satisfactory, as it does not illustrate the true nature of the condition, but rather misleads one in reference to the diagnosis, which should be made on clinical rather than on histological grounds. Treatment with X-rays has produced satisfactory results, but I would like to ask the President whether he thinks it is necessary to treat the premycotic patches; I think not, unless there appears to be hyperplasia.

The PRESIDENT said he thought that it was desirable to treat the premycotic patches, unless they were too numerous, especially as they were usually itchy, and some treatment was required for that.

[Dr. WHITTLE: They are certainly large but the patient does not complain much of itching.]

[1] *Proceedings*, 1932, xxvi, 121 (Sect. Derm., 1).

Pityriasis Rubra Pilaris.—Sir ERNEST GRAHAM-LITTLE, M.D.

I first saw the patient, a girl, aged 9 years, in April, 1932, when she was sent to me by Professor Langmead, who had been treating her for old infantile paralysis. I have been watching her case during the last eighteen months, and in that time she has had no treatment and it has been interesting to note the variations in the degree and extent of the eruption. She came six months ago with an exacerbation of the eruption, and to-day it is of very much less extent, and less prominent in respect of the spiny lesions. I do not think any treatment benefits the condition, and I am sure that spontaneous remissions of this kind do occur, the cause of which is very obscure.

[*February* 16, 1933].

? Lichen Planus. Case for Diagnosis.[1]—M. SYDNEY THOMSON, M.D.

Mr. D. L., aged 30, came to see me for the first time only yesterday evening, consequently no pathological investigations have yet been undertaken. The patient states that early last month a "spot" appeared on the left upper arm. The rash then spread down the arm, and was characterized by a fluctuating "redness and dryness." A little later a few similar areas appeared on the right arm; about ten days ago both thighs were seen to be affected. Three days ago the eruption suddenly began to get rapidly worse. There is only slight irritation.

Present condition.—The rash is thickly distributed over both arms, forearms, and thighs. A few sparse areas are present on the backs of the hands and on the legs. Last night there were also a few patches on the left flank; the patient definitely stated that these were not present when he dressed in the morning. During the day some slight redness had appeared on the face. The face shows only moderate erythema and very slight exfoliation; there are no papules.

The arms and forearms present a close aggregation of lesions, varying in size from that of a pin's head to that of a half-crown; some of the smallest are definitely follicular and a few are vesicular. Each lesion seems to spread centrifugally, and presents a curious laminated appearance such as is seen in starch granules when examined microscopically. The largest of these has a long diameter of about a third of an inch, but in places the larger areas are made up by their coalescence. These large patches are roughly circular and red, and bear scales which are particularly definite at the advancing free edges which point inwards. Some slight central resolution can be seen in two places. The gross picture resembles that seen in some forms of eczema.

The concentric laminæ are yellowish, and look as though they were composed of dry serous exudate, but gentle scraping at once proves them to be friable scales with a silvery psoriasiform flash. Detachment of the "nucleus," however, leaves a tiny pit with a shiny, dry base, such as may be seen in Darier's disease, but the horny plug is quite easily removed.

Similar lesions appear on the thighs, together with some follicular hyperkeratoses and "watch-spring" hairs.

The mucous membranes lining the cheeks show a thin and diffuse milky whiteness in which are long streaks like white hairs. There is no embroidery patterning, and no ulceration. The patient volunteered the statement that for the the past few days he had been conscious of an indefinite discomfort in the mouth.

General condition and past history.—Some dental caries and intestinal flatulence. Nothing else abnormal.

[1] The publication of this case was postponed until further particulars were supplied.

A small patch of "dermatitis" appeared over the right deltoid region about two years ago. This disappeared within about a month without treatment. There is no systemic disturbance and no adenitis. No drugs have been taken, and there has been no treatment of any sort since the eruption appeared.

POSTSCRIPT.—The patient would not allow a biopsy to be performed. Cultures from the various skin lesions yielded a few staphylococci only. Examination of the urine and fæces revealed no abnormality. It was therefore decided to treat the case as one of lichen planus, unguentum aquæ rosæ being applied locally merely as a soothing agent, and liquor-hydrargyri perchloridi being given by mouth. There was definite improvement a week later, and when the patient was last seen, at the end of March, the eruption had almost entirely disappeared.

Section of Odontology.

President—A. E. ROWLETT, L.D.S.E.

[*March* 27, 1933.]

A Misplaced Unerupted Upper Central Incisor: Operative and Orthodontic Treatment, supplemented by Ultra-violet Light Therapy.—K. CORISANDE SMYTH, L.D.S.E.

Patient, a girl then aged 12 years and 9 months, was admitted to the Royal Dental Hospital on November 11, 1930.

The upper left central incisor was not present in the dental arch. Skiagrams were taken, and showed a number of small denticles grouped around the crown of the unerupted incisor, which was lying diagonally above the root of the left lateral, its crown directed downwards, labially and medially.

November 22, 1930. *Operation* (Mr. Bowdler Henry).—Anæsthetic: endotracheal nitrous-oxide and oxygen. An incision was made over the unerupted tooth, the overlying bone was chiselled away, and five small denticles were removed. The tooth was examined, but was not interfered with in any way. The flap was sutured, and the patient was discharged on December 2, 1930. In February, 1931, a plate was inserted to expand the upper arch in order to make room for the central incisor. In July, 1931, sufficient room had been obtained, but there was no sign of eruption of the tooth.

In September, 1931, fresh skiagrams were taken, and it was decided to use mechanical means to bring the tooth into place. A band was made, to fit the erupted incisor, of very thin iridio-platinum, with a small hook soldered on the labial surface, ready to be cemented on to the tooth to be moved. On September 25, 1931, the patient was again admitted to the ward, and Mr. Bowdler Henry reflected the gum over the unerupted tooth and cemented the band in position. A fixed appliance was constructed for the upper arch, but no pressure was put on the left upper central until November 21, 1931, when the soft tissues had completely recovered, and the tooth was fairly firm. A coiled spring of platinized gold, 0·5 mm. in diameter, soldered to a lingual arch, and lying vertically in the space below the tooth, had its free end hooked on to the spur on the band, and the pressure could be regulated very easily. On December 11 the tooth was rather tender; progress was then slow and uneventful until March 4, 1932, when the soft tissues showed some inflammation, and the tooth was somewhat loose. Pressure was slackened off, and a course of ultra-violet light was begun. Between March 4 and June 14 there were six general applications (to back or chest), and three local applications. This treatment was carried out in the electro-therapeutic department of the Royal Dental Hospital by Mr. F. Talbot. It had a marked effect on the condition of the tissues; in April the tooth was tighter and the gum very healthy, and there was no recurrence of trouble. There appears to have been a stimulus to bone growth; at all events it was possible to move the tooth more quickly during and after the ultra-violet light treatment, and the later skiagrams show a satisfactory degree of bone-growth around the root.

When the incisal edge of the tooth came down to the level of the necks of the adjacent teeth, it was necessary to use a different type of spring, and various kinds were utilized, with slightly increased pressure as the tooth tightened up. In May, 1932, a labial extension from the lingual arch was brought round, distally to the right first premolar, curled opposite the right central, and the free end lodged on the spur of the band. At this time the tooth was rotated with the medial border forward and the distal corner slightly overlapped by the lateral incisor; a spring was soldered on the lingual arch to move the lateral liabially and distally, and subsequently another spring was used to bring forward the distal border of the central incisor.

On October 6, 1932, the crown of the tooth had emerged completely from the soft tissues, and a new band was made for it. On November 17, 1932, just one year after the appliance was inserted, the incisal edge of the left central was on a level with the incisal edge of the left lateral incisor, and a skiagram taken at this time shows the density of the newly formed bone, while the outline of the original position of the tooth can still be traced. On March 14, 1933, the fourth skiagram was taken, and on March 23 the incisal edges of the two central incisors were on the same level, but the moved tooth had a slight labial inclination, not having quite sufficient room to fit between its neighbours. Therefore the band was removed, and the labial spring adjusted to give a slight lingual pressure. At the last inspection the tooth had become slightly loose again, and if it does not tighten satisfactorily, further ultra-violet light applications will be given. The tooth responds normally to thermal changes.

Unique Dental Cyst.—E. B. DOWSETT, D.S.O., L.R.C.P., M.R.C.S., L.D.S.E.

E. S., male, aged 19 years, was seen at Guy's Hospital on January 28, 1932, having a swelling on the left side of the mandible. This swelling was of bony hardness, smooth in character, swelling both plates of the mandible, the outer more than the inner. There were no signs of inflammation and the swelling had only been painful for the previous few days. Skiagrams showed a typical large dental cyst, extending from the left canine to the first molar and down to the extreme lower border of the mandible, both inner and outer plates being extremely thin. The left first premolar was missing and the patient gave a history of having had it extracted about a year previously. The left canine was much displaced by the root being pushed forwards by the growth of the cyst and its crown thus tilted backwards. The left second premolar was likewise displaced by the root being pushed backwards and its crown tilted forwards. This displacement of the teeth in the immediate neighbourhood of a cyst was noted as being unusual with cyst formation. I operated on February 4, 1932, under a general anæsthetic. After reflecting a large flap of gum tissue and separating the soft tissues right down to the lower border of the mandible, I opened the cyst and removed the outer wall. The cyst contained—not the usual fluid or even the soft cheesy material sometimes found—but a hard substance of leathery consistency and absolutely dead white in colour. After dissecting and removing the whole of the outer cyst wall, I removed—in as large pieces as possible—the hard white contents and then found the typical glistening epithelial cyst-lining membrane below. This lining membrane was found to be so very loosely connected to the bony wall that it was removed entire and not left attached to the inner wall, as it is in my usual procedure. The gum flap was then tucked in and the cavity packed with sterile gauze for twenty-four hours. The patient made an uneventful and rapid recovery. Microscopically the cyst membrane was found to be lined with a stratified squamous epithelium. The white contents, of which several sections were cut in various directions, consisted simply of layer upon layer of keratinized epithelium and were utterly devoid of any cells or vessels. This, as far as can be ascertained, is quite unique.

Hypertrophic Gingivitis.—FRANK COLEMAN, M.C., L.R.C.P., M.R.C.S., L.D.S.E.

The patient, a healthy looking woman, aged 19, noticed on September 22, 1932, that her gums were swollen and the swelling was gradually increasing.

She first attended the Royal Dental Hospital on October 6, 1932. There was then general hyperplasia of the gums more marked in the incisor region of either jaw. The teeth were in good condition, but loosened and much covered by the overgrowth of gum tissue. The rest of the mouth was in a healthy condition.

Enlarged lymphatic glands could be felt beneath the jaw on either side. No apparent cause for the hypertrophy could be found and nothing in the history indicated or suggested a cause. As an aid to diagnosis the following investigations were carried out: Radiographic examination of all teeth; cultures and direct films made from gum pockets; blood examined and blood-count made; portion of gum excised for microscopical examination.

As an aid to treatment the following procedures were carried out: Teeth scaled and gums atomized; local application of astringents and iodine; mouth-washes—such as Carrel-Dakin solutions and peroxide of hydrogen; vaccine treatment (11 injections at appropriate intervals, commencing with 5 million streps. and reaching 100 million streps.), the administration of avoleum (a vitamin-A preparation) and partial gingivectomy.

Within six months the patient had lost over a stone in weight, and she complained of feeling weak and of becoming easily tired.

In October, 1932, she had appendicitis and was admitted to the Paddington Infirmary for two or three weeks. It would be interesting to know whether there was any causal relationship between the mouth condition and the appendicitis, as a similar incidence has been noted in other cases.

None of the investigations up to date has thrown any substantial light on the pathology of the condition. The interest of the case lies in the rapidity with which it developed, for within a week the gums had reached almost their present hypertrophied condition.

Pathological Changes in a Composite Odontome.—G. B. PRITCHARD, L.R.C.P., M.R.C.S., L.D.S.E.

This composite odontome possesses unusual features. It arose from the germs of the lower second and third molars which had fused at about the second year of life. The crown and the anterior root of the second molar are not abnormal, but the posterior root and that part of the mass arising from the third molar germ form a hollowed-out globe lined with enamel in parts, and completely filled with a combination of calcified connective tissue resembling bone, and uncalcified connective tissue with much dental epithelium. Part of this epithelium has undergone cystic degeneration. The dentine is excessively hypoplastic and enamel epithelium has penetrated these areas and prevented further dentine calcification in them. It has then either produced enamel, or atrophied to allow the filling-up of these areas with tissue calcified from the cells of the follicle. This is the first example that I have seen of an apparent invasion of calcifying connective tissue by epithelium.

Restoration Appliances for use after Excision of the Maxillæ and Partial Excision of the Mandible.—HAROLD ROUND, L.D.S.E., M.D.S.(Birm.).

On an original model obtained from an impression taken before the operation, a vulcanite base plate is made to fit that part of the maxilla or mandible which is to remain. Where possible, remaining teeth are used for retention. Wires or flattened coiled stainless steel springs are attached to the free edge of this plate and after the operation, with the plate in position, these are roughly bent to bridge the area to be restored. These wires are covered with a blob of soft wax, reinforced with hard wax, and the softened mass is moulded by finger and spatula to the required restoration. The wax mould is then reproduced in hard and soft (vela) rubber. After the original impression, no further impression is necessary; all further moulding, additions, etc., which may be required, are made by wax moulding in the mouth. One restoration appliance comprises the right half of the maxilla, nose, eye socket and right side of cheek. The palatal restoration appliance carries two vertical pins, on the top of which rested two horizontal tubes; into these tubes were fitted two pins carrying a

cheek and eye-socket restoration, constructed of hecolite; further retention of the cheek shield was obtained by the use of glasses. From the right arm of the glasses a piano-wire spring was attached, one end of which rested on the top part of the shield.

Appliances for Radium Treatment.—HAROLD ROUND, L.D.S.E.

The construction is carried out in the same way as that of the restoration appliances, that is to say, wires are attached to the free end of the vulcanite plate; these wires are bent to cover the area of the growth and wax, attached to these, is moulded to cover the growth. The next stage is the construction of a vulcanite box over the growth, with a lid made of lead, and continuous with the leaden protective layer covering the whole plate. This lid is hinged on one side and on the free side there are fixed two sections of a tube which articulate, when the lid is closed, with similar sections of tubes on the edge of the box; these tubes are then locked by means of a pin fitting into what becomes a continuous tube. Two or three bite pillars constructed of hard vulcanite and carrying soft rubber mountings are fixed to the leaden surface of the applicator; this enables the patient to rest the upper and lower teeth or gums as the case may be, on the soft rubber pads, thus keeping the appliance in position and resting the lower jaw.

The radium needles are laid in wax inside the box and the lid is closed and bolted.

Such appliances are comfortable to wear and the needles are perfectly safe. Further, the maximum amount of protection can be given.

(1) **Spread of Caries in Hypoplastic Dentine.** (2) **Structure of Enamel Lamellæ.**—J. G. TURNER, F.R.C.S., L.D.S.E.

Mr. J. G. Turner showed:

(1) Ground sections of carious hypoplastic teeth showing that caries spreads no more rapidly in the hypoplastic dentine than in the normal dentine.

(2) Microscopic preparations showing the structure of enamel lamellæ. The lamellæ were isolated by decalcifying the enamel. The coarser lamellæ showed clearly the prismatic structure of enamel; the finer lamellæ were structureless, but showed well their continuity with the surrounding prism-sheaths (or inter-prismatic substance). Both forms were attached to Nasmyth's membrane. Lamellæ were indestructible by acid, and had no set relation to enamel caries. He had in some cases traced the coarse lamellæ right across the carious area. He doubted their importance as portals of entry of caries. To explain the widespread simultaneous onset of caries—seen, e.g. on the buccal surface of a last molar—as due to lamellæ, was to imply that the whole enamel of the part was made of lamellæ.

Myxoma of Mandible.—L. EDMUND CLAREMONT, L.R.C.P., M.R.C.S., M.D.S.

Grace S., aged 37.

27.5.31.—Patient reported complaining of swelling in lower incisor region of two months' duration. A skiagram showed rarefied area in the mental process, suggesting a cyst. 5.6.31.—Operation in the Royal Dental Hospital In-patient Department by Mr. J. G. Turner. Cyst found to be an encapsulated tumour; this was completely dissected out. Microscopical examination showed myxoma. On discharge from hospital patient was put under weekly observation. Patient complained of neuralgic pain in mental region. 6.1.32.—Further skiagram of 3 | 3. Further section of deeply injected gum sent to Pathological Department. Report: myxomatous material. 22.1.32.—Patient readmitted to the ward, and $\overline{|3}$ removed, with large piece of alveolus. Patient kept under observation until 5.10.32. Drab patch on gum increasing in size, and a good deal of neuralgia. 12.10.32.—3 | and section of bone extracted [L. E. C.]. Microscopic findings of apex and bone negative. 15.2.33.—Skiagram of mental region: rarefaction evident.

Case referred to Mr. L. R. Broster, who advised extensive resection of bone, probably including lower border of mandible.

Myeloma of Mandible.—L. EDMUND CLAREMONT, L.R.C.P., M.R.C.S., M.D.S.

Garald Thoumaian, male, aged 80.

18.5.32.—Patient complained of tenderness of gum in lower jaw with some scattered ulceration. Skiagrams showed indefinite rarefied areas in bone from $\overline{6}\,|\,6$. $\overline{321}\,|\,123$ smoothed.

25.5.32.—Region $\overline{5}$—$1\,|$ opened up with block anæsthesia. Specimen of growth removed for microscopic examination. Report—myeloma.

Patient sent to Mr. L. R. Broster at Charing Cross Hospital for opinion. Extensive resection of jaw advised, but patient refused to undergo the operation.

[*November* 28, 1932.]

The Use of Diatol in Dental Diathermy.

By C. BOWDLER HENRY, L.R.C.P., M.R.C.S., L.D.S.E.

(*Casual Communication.*)

THE author reported upon the use of diatol in medical diathermy of the alveolar ridges, with special reference to the treatment of residual infection. Mr. Henry said that his experiments extended over the past eight years, and he had reached the conclusion that, whereas surgical diathermy for the removal of tissue and for the sterilization of root-canals was undoubtedly useful, the advantages of the medical application of these currents quite outweighed its surgical uses. He first employed diathermy to the inside of the mouth when treating a case of persistent neuralgia of the trigeminal nerve by diathermy on the external surface of the face. A number of these cases of neuralgia were undoubtedly due to infection persisting after the removal of septic teeth, and were of the type sometimes, but not always, successfully treated by curettage of the alveolus. The author's earlier cases were treated by an intra-oral electrode designed like a vulcanite base-plate, tin-lined over the portion of the ridge receiving treatment, the metal lining being connected by a wire through a projecting vulcanite stem to a terminal outside the mouth (fig. 1A). The

A B

FIG. 1.

details of this construction have been previously published.[1] His more recent technique was a development of the original process, in which a "stock" electrode of similar construction was chosen, like a stock-impression tray, rather larger than the case to be treated, plastic insulating and conducting impression compounds being appropriately distributed to fill the intervening space (fig. 1B). The insulating material used was ordinary dental composition. The conduction composition, which was new and was called diatol, was a hydro-colloid substance of proprietary make.

FIG. 2

Mr. Henry then showed a series of lantern slides illustrating the steps of the technique for making the plastic lining, when an electrode was being fitted to the mouth. He also showed illustrations of the same process using a softer form of diatol for application to the irregular external surfaces of the body, such as the face (fig. 2).

Finally, he showed photographs and skiagrams of a case of arthritis of the elbow due to residual dental infection, in which intra-oral diathermy by this method had proved exceedingly beneficial.

[1] *Brit. Journ. Radiol.*, 1932, v, 807.

Section of Otology.

President—J. F. O'MALLEY, F.R.C.S.

[*May 5, continued.*]

Demonstration of a New Apparatus for Examination, Diagnosis and Therapeutics of Chronic Deafness.

By Dr. ISIDOR MÜLLER (Karlsbad).

MY new apparatus, which I call the "Iatrophone," is an electric interference-tone-generator, equipped with a quartz crystal and constructed from the most modern points of view for diagnosis as well as for therapy. The quartz crystal makes it quite constant in frequency to a degree of 1 per mille. If the temperature does not change within certain limits, the constancy is still greater. Another important quality besides the constant frequency is the pure sinusoidal form of vibration, which can be shown on photographed tone-waves. The careful and elaborate technical construction of the apparatus allows the use of different voltage, 100 to 120, 200 to 240 volt a.c., 40 to 60 cycles. We have succeeded in constructing a small portable unit of about 16 lb. weight, for the scientific testing and treatment of the ear. The low price will also be an advantage.

The connection with the patient's ear, for translation of acoustical vibrations is effected by a device, which is, in fact, a loud-speaker of special construction, suitable for transmission not only of simple tones, but also of complicated tones and noises such as speech and music. Therefore we can transmit not only tones produced by the tone-generator, but also tones, noises, speech and music of electric gramophones, speech- and tone-records.

The diagnosis and therapeutics of chronic deafness are so closely involved that they cannot be really separated. The following points of view will always be taken into consideration by us.

The hearing is first tested by whispering, or in the case of very deaf persons by loud speaking. We avoid the use of figures, as after a short time the patients guess the numbers by the cadence and phonetics. After the speaking test, tuning-fork tests, etc. (Weber-Rinne-Schwabach and Gellé) are made. Further, the air connection is examined with tuning-forks of different-keys, from bass C to C 4. As ordinary tuning-forks are not sufficiently reliable to ensure prevention of mistakes, for twenty-five years we have used our electro-magnetic tuning-forks, and for several years an apparatus by which tone-frequent currents are used. The first advantage of these is that we can produce every audible tone, and tones beyond, which are almost free from overtones. The second advantage is, that in this manner we fulfill a postulate, which could not be fulfilled hitherto. The continuous tone-succession from Bezold-Edelmann has the great deficiency that

the sounds used are of different origin, being produced partly by means of tuning-forks and partly by whistles. Moreover, some doctors had used the monochord—an invention of Pythagoras—as completion, to state the highest limit of hearing. (About 15,000 vibrations.)

As already said, this important deficiency can be avoided by using tone-frequent currents, or frequencies of electric oscillations to produce a continuous succession of tone; so that, while all tones are generated by electro-acoustical vibration of different frequencies, all are of the same origin.

With this apparatus it is possible to obtain from 0 vibrations to far above the limit of hearing—20,000 and more vibrations, sounds of various keys, which can be applied for testing hearing.

Another advance made possible by the use of this apparatus is that we are thereby enabled to test the air-conduction as well as the combined air-bone-conduction, or bone-conduction alone, if required, bringing the end of the device either quite close to the meatus, or inside the meatus, or applying it to the mastoid process. In the latter case experience has shown that it makes a great difference, whether the end-piece is placed on the point, which corresponds to the antrum, or on the descending portion of it, and in this way, and also by comparison of the two, it is often possible to procure information about the pneumatic condition of the mastoid.

A further advantage of this method, in comparison to the old test with tuning-forks, is that we are able to vary the tone as required—the height of tone as well as the tone-intensity, from 0 to strong intensity, which we can produce in a more rational way than with tuning-forks. The height of sound, as we know, depends on the frequency, the intensity on the intensity of the electric current.

An important point to note is that we are able to measure the length of time till the central perception of sound, and it is of great advantage that we can change the quality—as well as the intensity—of sound, *ad libitum*. Moreover, we are able to ascend and descend scales with any speed, or to use the same quality and intensity of tone as long as we wish, and thus test the perception-faculties of the auditory nerve in every way.

One of the most important points about the whole method is, that we are thereby enabled to find the threshold of hearing for all these acoustic phenomena, from 0 to the audible point and vice-versa from a loud tone to 0. We do it both ways because we have found that they are not quite identical, but frequently show certain differences. As already mentioned, we use a specially adapted device, suitable for examination not only with simple tones, but also with complicated tones and noises, such as speech and music. In this way valuable information is supplied as to the condition of the auditory nerve and its capacity of perception. That is of great importance in various respects, because thereby we often obtain information as to the process of perception, especially in regard to central hearing, i.e., central perception of the auditory phenomena. The tone-frequent currents can also be used as simple stimulators without sound. The idea is to send currents to the auditory nerve, which have exactly the same amount of vibration as the corresponding tone. In this way one can excite the auditory nerve without tiring the brain with tones, using an intensity below the threshold of stimulation. A similar effect can also be produced through those tone-frequent currents, which attain tones above and below the range of auditory perception. Thus, in cases of advanced deafness it is not necessary to go beyond the general absolute range of perception of tone, but for these cases there are already otherwise audible tones, outside of their individual range of hearing (extratonal), and it has been often possible, by continuous use of such supratonal or infratonal frequencies and intensities, to increase or finally restore the patient's tonal perception.

This apparatus and method of diagnosis and treatment of deafness, producing

a substantially continuous spectrum of frequencies from the infratonal to the supratonal bands, and varying the intensity of each separate frequency over a wide range of values, further enable us to discover isles of hearing and the gaps between by noting the responses of the subject to the several frequencies and intensities. This enables us to treat the patient, with regard to the gaps of hearing, by transmitting the frequencies corresponding to these gaps into the ear.

It is in fact a method of education, covering the gaps and widening the corresponding range of hearing by continued and suitable application of adequate frequencies.

This kind of tone production is exceedingly adaptable for training the auditory nerve. Not only the simple musical tones, however, but also musical and talking records are of great importance. For this reason we have connected our apparatus with an electric gramophone of special construction. We have studied a number of cases of high-grade deafness in which music could no longer be perceived as such, but simply as a noise, an *omnium gatherum* of confused sounds. These cases were exceedingly interesting, because the deficiency of perception had resulted from quite different causes. By some there was such a retarded perception of the single tones, that naturally, by the quicker change of tones, the melody could no more be perceived, as the tones became totally confused. Up to a certain extent one could already somewhat correct this by suitable retardation of the music.

In other cases, no slow perception of single tones could be found, but the perception of a variety of successive tones was impaired. When we applied higher or lower, weaker or stronger tones, of the same or different kind in slightly quicker succession, only a muddled noise could be heard. In both kinds of cases we were, by practice, able to abolish this deficiency, and after several weeks the music was heard as such. The patients assured us spontaneously, that for the first time, after a long period, the music had been a pleasure to hear.

It is possible, therefore, in a number of cases to revive the perception faculties from that of simple tones to that of complicated melodies, our method being to proceed from the use of simple tones to that of whole scales, up and down, changing rapidity and intensity. Possibly we may assume that a similar procedure takes place in the ear to that in the eye, where the so-called " after-images " arise on the retina. In our cases it may deal with after-images in the labyrinth or in the different stations up to the cortex. One can restore the perception through the influence on the labyrinth and on the central auditory paths, and produce the right perception through the cerebral cortex and consequently the consciousness of the acoustic phenomenon.

Returning to the subject of the stimulation-threshold: We can determine not only the stimulation-threshold of different sounds, but also the range of hearing for different intensities and heights of tones. We can also state the exact time of perception more precisely than by any other method. This is a very important part of the treatment and the judgment thereof, the more so because, as already said, we can use simple tones as well as music and speech in the same manner for testing as for treatment, which leads to a deeper insight in the process. We also observed in a great number of cases, that the auditory subjective sensations, noises as well as disturbances of the equilibrium, irritations of the auditory nerve, could be influenced in a favourable manner.

With regard to the speech records: We know that in many cases of deafness an improvement of hearing can be obtained through long training. But our kind of training is much more practical, as a great variation of words and sentences can be used without tiring the doctor or his assistant. (Use of singing, etc.)

The cases of vertigo, which we have treated—and still treat—with our electromagnetic tuning-forks, to aid the treatment with tone-frequent currents, show that the forks have the advantage of great mechanical influence, especially the deeper

ones. The tuning-forks, as it is known, make everything, on which they are set, vibrate in the same way as they do themselves. Thereby not only the auditory nerve and the labyrinth but the whole skull with its contents are brought into vibration. Thus, it seems, that an intensified activity will be induced in the brain and the cerebral cortex, the circulation of the ear and the whole head will be greatly stimulated. One may observe in many patients—especially in nervous patients—a redness of the side of the head on which the tuning-fork is set. By disturbances of the equilibrium the deep tones, of the forks as well as of the apparatus, from 100 vibrations down are proved to be the most efficacious.

In conclusion: we do not wish to overthrow the old methods without reason or without providing a complete equivalent but we hope that we have contributed a little towards progress in the examination of the ear and in the treatment of deafness, and have produced an apparatus that will be of use both for the aural clinic and for the medical practitioner.

Demonstration of High-frequency Apparatus.

By Dr. ISIDOR MÜLLER.

THE electric high-frequency field has opened up a new range of application of extremely frequent vibrations.

The body of the patient has not to be brought in contact with any kind of electrode as is the case with the customary methods. The extremely high frequency can be finely and individually administered with this apparatus, adjusted according to the required effect. This fine, individually adapted regulation is absolutely necessary in order to influence the inner organs in any appreciable degree. Exact measurement has shown, that diathermy can never have this effect, since it would require an electric energy of a degree which would lead to complete combustion of the surface. The diathermic current has quite a different influence upon the human tissue from that of extremely frequent currents. The usual diathermic current has, in fact, no penetrating power, not being able to overcome any larger resistance of conduction, while the ultra-high-frequency currents penetrate the whole body so that any of the inner organs, however deep, may be influenced by them. According to numerous observations, even the deepest parts may be heated, if there is any abnormal resistance, as, for instance, suppurative focuses, abscesses, infiltrations, etc., it means that there are places, where circulation and consequently caloric conduction are disturbed, i.e., diminished. The result is a much greater and quicker calefaction of these parts in comparison to their surroundings. This important observation leads to selective action and treatment. The best effects have been accomplished in cases of inflammatory congestion, infiltration and suppuration, suppurative focuses, etc. The apparatus is equipped with the finest regulator of energy and frequency, to adapt it for the treatment of ear, nose and throat troubles. It produces high frequency up to 65 mega cycles. We have frequently been able by its use to avoid operations in cases of acute inflammation, and to treat with good results many cases of chronic catarrh.

It is expected that treatment with extremely high frequencies will bring about a considerable change in the practice of medicine. The effect of this kind of rays extends beyond our present range of vision.

Sir JAMES DUNDAS-GRANT said that he wondered whether the time taken by the auditory stimulus to reach the brain could be measured; this was slower in some than in others, and it might be a further aid in deciding in which cases there was nerve-deafness.

Section of Otology and Section of Laryngology.

COMBINED MEETING WITH THE SCOTTISH SOCIETY OF OTOLARYNGOLOGY.

Chairman—J. F. O'MALLEY, F.R.C.S. (President of the Section of Otology).

[*June* 3, 1933.]

Erysipelas and the Hæmolytic Streptococcus in Relation to Oto-Laryngology.

By DAN MCKENZIE.

Is all well with our aseptic methods?

Not only is ordinary erysipelas more common in the face and head than in any other region of the body, but nowadays we oto-laryngologists have to suffer the reproach of furnishing most of the cases of post-operative erysipelas, and what is more, of post-operative scarlet fever as well!

First of all, in order to afford some idea of the frequency of erysipelas in our work, the following figures, for which I am indebted to Dr. A. Miller, First Assistant to the Central London Throat and Ear Hospital, may be cited. During the five years 1924-28, 28 cases of erysipelas occurred among the hospital in-patients, all but one being post-operative. Two of them were fatal. The operations affected were: 19 mastoids—14 cortical (Schwartze) and 5 radical; 3 Caldwell-Luc; one external frontal sinus; one tonsillectomy, with post-nasal curettage: one operation for cervical adenitis; one epithelioma of the soft palate, and one epithelioma of the maxillary antrum. Thus the majority were consequent upon mastoid operations, the proportion to the total of these operations being shown in the following figures: The total number being 1,358, the percentage developing erysipelas was 1·4. Of these, 2·5% were cortical and 0·6% radical. In the nose and throat operations only 8 developed erysipelas, and of these 4 followed operations on the nasal sinuses.

The overwhelming preponderance of acute ear cases is to be noted.

Erysipelas is a contagious disease, tending to spread from person to person by direct or indirect contact. But, while it is impossible to doubt its occasional dissemination in this way in our hospital wards, observation shows quite clearly that a considerable number of the cases are of autogenous origin. Thus, while we find little runs of two or three cases happening within a few weeks, many sporadic cases also occur in which no connection with any other case of erysipelas, in the hospital or out of it, can be traced.

Bacteriological commentary.—Although it is said that clinical erysipelas may be induced by the staphylococci, the *Bacillus coli communis*, and other pyogenic organisms, in the vast majority of cases it is a streptococcal manifestation. That being so, we shall make a brief survey of the interesting and valuable work of the last decade on the hæmolytic streptococcus, work which bids fair to revolutionize both opinion and practice.

The tendency nowadays is to regard the *Streptococcus hæmolyticus* (our vague old friend the *Streptococcus pyogenes*) as responsible for a group of clinical happenings which comprises not only many of the acute ear and nasal sinus infections with which we are so familiar in oto-laryngology, but also epidemic and hospital tonsillo-pharyngitis, erysipelas, the commoner forms of puerperal septicæmia and scarlet fever.

This opinion denies specificity to the particular streptococcal strain present in any one of those diseases, both laboratory and clinical experience suggesting that the *Streptococcus hæmolyticus* has the remarkable power of varying its behaviour to suit its bio-chemical environment. As Andrews and Christie have said:—

"The more one studies hæmolytic streptococci the more strongly is the impression gained that they are in a state of constant flux." And this "organism as an invading parasite appears to have a special facility in adapting the refinements of its living chemistry to the particular host in which it finds itself." Almost you might say as if it had a bio-chemical intelligence!

So when it has assumed one particular character, as for example the erysipelatous, while it tends to retain that form in attacking other people, that tendency may be overcome and another form assumed. Thus in one household or in one hospital ward it may induce a case or a series of cases of any one or all of its various manifestations. To cite a recent experience of my own: the father of a family was attacked with severe erysipelas of the face; at the same time his daughter, aged 8, had septic tonsillitis; five weeks later his wife fell a victim to the throat infection, later developing acute rheumatism and a toxic psychosis. That is to say, an erysipelas or an acute otitis media, or an acute nasal sinusitis may initiate, or may itself be one item in, what can only be called a streptococcus epidemic.

The inclusion of scarlet fever in this grouping comes as a surprise. One had long believed in the specificity of that disease. And for that matter its inclusion with erysipelas is not even now agreed to by all authorities. Thus the Dicks in America, the originators of the Dick test in scarlet, and Griffith in England, seem to regard the strains of the streptococcus found in scarlet as specific. Clinically, however, there are many phenomena that support what Okell calls the "unitarian doctrine."

Thus, just as there is a "surgical" erysipelas arising *de novo*, so is there a "surgical" scarlet that strikes out of the blue in the same way. In these cases the streptococcus is found in the surgeon's wound and often not in the throat at all. If it passes on to infect someone else, however, streptococcal pharyngitis with the ordinary scarlet rash is the result.

Then we have the streptococcal pharyngitis that occurs without any rash in certain people exposed to scarlet. It is interesting to note that when the Dicks inoculated the pharynx of healthy volunteers with the scarlatina streptococcus, some developed true scarlet, rash and all, while others developed only pharyngitis. Recently, we may add, streptococci from erysipelas have been inoculated on to the pharynx with the production of pharyngitis, but not it would seem of cutaneous erysipelas.

In this connection also we may allude to epidemic milk-borne pharyngitis with its high mortality, and likewise to the ordinary septic pharyngitis that is so often followed by acute rheumatism, both of which are streptococcal infections. (By "pharyngitis" we mean throughout "tonsillo-pharyngitis.")

These pharyngitis organisms, we may say, are both pyogenic and erythrogenic (red-rash-producing) when tested in the laboratory, and Okell believes that the toxigenicity of the streptococcus may be increased as it passes from host to host until it reaches the erythrogenic phase, and then it will produce scarlet in any susceptible person—or in like manner, we may perhaps add, erysipelas.

Further, Glover and Griffith have shown that epidemics in schools, of influenza, common cold, measles and tonsillitis, seem to exalt the epidemic activities of the hæmolytic streptococci both as pyogenes and as erythrogenes. Otitis and mastoiditis become common, and scarlet may originate *de novo*.

This last statement brings the whole position vividly before our eyes; we are actually witnessing the dawning recognition of a new infectious disease; and we can now realize how, when erysipelas appears in our wards, it may arise either (1) from

another case of erysipelas; or (2) from a streptococcal infection, not erysipelas, in another person; or (3) from a streptococcal infection, not erysipelas, in the patient himself.

But when a streptococcal disease develops, what happens? Are the quiescent streptococci present in the patient's throat or nose transformed into virulent streptococci in response to some change in their host's biochemical constitution, or "humours," to use the old medical term? Or are they stimulated to change their habit by the invasion of virulent streptococci from some other patient? Or are the quiet inhabitants evicted and replaced by aggressive strangers?

Bacteriology does not so far seem to be able to answer those questions. But clinical experience with influenza and the exanthemata suggests that native streptococci may spontaneously acquire invasive and toxic properties, and that when they do so they become also capable of infecting other people. But the conditions producing the change do not seem to have so far been precisely determined. They may be complex in character.

Inasmuch, then, as the organisms appear to be most virulent and infectious when they are actually involved in a disease-process, too much attention need not be paid to the presence of hæmolytic streptococci in an otherwise healthy throat. The streptococcal infections in our regions most likely to lead to an outbreak of erysipelas or scarlet are acute otitis media, acute nasal sinusitis, and acute pharyngo-tonsillitis.

These diseases are therefore to be regarded as infectious.—The influence of this striking conclusion upon our doings will be discussed later. All we need say at the moment is that erysipelas must now be looked upon as a red flag indicating the presence of a streptococcal epidemic, more or less widespread and more or less latent.

I proceed now to mention a few details on the *Symptomatology* of erysipelas itself of particular interest to the oto-laryngologist.

Clean operation wounds are more liable to the infection than those already septic; a point of importance to us, since our operations of access to the mastoid and the nasal sinuses pass through clean tissue. At the same time, although septic wounds are less liable to the infection, they are by no means immune from it.

Non-operative erysipelas often starts in the nose, and it extends to the nasal interior also from the face, giving rise to much swelling of the turbinals and general mucosa. The pharynx also may become involved, though it does so less frequently. The auricle, like the nose, is a favourite site of origin, usually from a patch of eczema with hacks or cuts. Erysipelas starting in the external auditory meatus secondary to acute suppuration of the middle ear is uncommon apart from operation. But I am able to report a case.

The patient, a woman aged 34, was admitted to the French Hospital, London, on December 22, 1932, with erysipelas of the right external meatus and auricle of two days' duration. The ear had been discharging since December 1, in what was its first attack of suppuration. After a severe illness of three weeks, leading on to cystitis, recovery took place and during convalescence the ear discharge completely ceased and hearing was restored. No operation on the ear was performed.

Besides these, an intense streptococcal laryngitis in adults is known to us. Here is the chart (fig. 1) from such a case in which the antistreptococcus (scarlet) serum had an immediate and lasting effect. The ripe-Victoria-plum appearance of the arytenoids and ary-epiglottic folds was most striking. We may also mention here the classical Ludwig's angina, which, though not an erysipelas, is a cellulitis due to streptococcus infection.

Curiously enough, in spite of the proximity to the meninges of the infected areas in nose and ethmoid, erysipelatous meningitis is quite rare. It is stated that there are only nine cases on record. Moreover, erysipelas has been known to occur after

submucous resection of the nasal septum without inducing meningitis. Apparently, therefore, something more than the simple infection of the nasal lymph-spaces and vessels is necessary to open the avenues to the intracranium. Meningitis, apart from ear infection, is rare also in scarlet.

Save at the extremes of life, the mortality rate of erysipelas is low, running about 5%. But it varies considerably from epidemic to epidemic, just as it does in scarlet and all other streptococcal diseases. J. D. Rolleston has repeatedly drawn attention to the astonishing and steady decline in the mortality of scarlet fever in England during the last sixty years (from 25% to 0·6%).

Surgical erysipelas is more dangerous to life than the spontaneous variety, but a great deal depends upon the nature of the operation. Most of us have had frequently to fight long and furious battles for our cases and have emerged victorious.

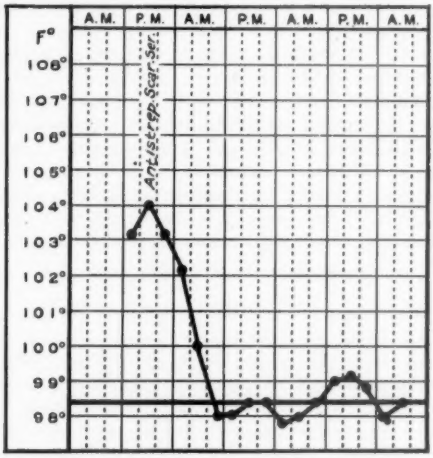


FIG. 1.

It is remarkable that even when he seems to be on the point of death, comatose and pulseless, the patient may suddenly revive and recover. It is worthy of note, too, that the onset of erysipelas at the end of a long general septicæmia may usher in recovery.

Turning once more to our septic problem, we may claim that, while the hæmolytic streptococcus may cause much morbidity, unexpectedly prolonging the patient's stay in hospital, it has, at the present day, but little effect upon mortality—directly, at all events. Deaths attributable to such infections are, on the whole, rare, even when we include scarlet fever and otitic meningitis. But, although the streptococcus infection is relatively seldom a direct cause of death, the fact that it leads to so much morbidity is not to be ignored.

It is instructive to compare our commoner operations as regards their tendency to post-operative sepsis.

The cortical mastoid for acute otitis is probably the most vulnerable. Nevertheless our mortality keeps under 5%, which, everything considered, is nothing to be ashamed of.

The external frontal sinus operation, whether for acute or chronic sinusitis, is less frequently performed than the mastoid operations, and what the relative incidence of their post-operative sepsis may be I have no figures to show. But my own experience has been that it is quite common, probably as common as after the mastoid operations.

The maxillary antrum with acute sinusitis is seldom operated on, apart from simple puncture; but in chronic cases a more or less septic course subsequent to operation is usual. It leads to erysipelas much more rarely than the mastoid operations. The same remark applies to ethmoidal and multiple sinus operations.

After the removal of tonsil-adenoids in children, apart from special infections, sepsis is occasional, but, as a rule, brief, unless it leads to acute otitis media. Only a few are prolonged for more than ten days. One, I remember, ran a septic temperature for six weeks, then developed erysipelas and recovered. I cannot recall any more than two deaths from sepsis out of many thousands of these operations.

With regard to tonsils in adults, bacteriologists are inclined to be timid, so frequently is the hæmolytic streptococcus present in them. Nevertheless, my experience is that we get less septic infection after this operation than any other—a surprising fact.

I wish I could say as much for the submucous resection of the nasal septum. But here the surprise is the other way about. The occurrence of a streptococcal tonsillitis within ten days of the operation (sure indication of an infected nasal wound) is altogether too common. Fortunately for our reputations it is invariably diagnosed as a "cold." It can be aborted by an immediate dose of antistreptococcus (scarlet) serum. Moreover, it certainly becomes less frequent when Sir StClair Thomson's bismuth tampons are used, bismuth being a mild and reliable nasal antiseptic.

For the treatment of erysipelas in being, the favourite general remedy at the moment is the antistreptococcus (scarlet) serum, 20 c.c. daily for three or four days according to its effect. It acts most rapidly and satisfactorily if given within twenty-four hours of the onset, but results on the whole are variable, although it seems to have a beneficial general effect. The ordinary polyvalent antistreptococcus serum is useless.

I have not found the intravenous route of any advantage in serum administration and blood transfusion has also proved disappointing. But I have obtained striking benefit from auramine (Arnold Renshaw) administered intravenously, and show a chart to illustrate its effect (fig. 2).

Local remedies are legion. Recently, X-rays have been credited with great success, and the orthodox treatment of the day consists in a combination of X-rays for local, and the anti-scarlet serum for general administration. One of the characteristics of erysipelas, however, is an indefinite course together with a tendency to unexpected and quick recovery, features that render the estimation of the value of any remedy difficult.

Views on prevention.—Now although it is true that the visible effects of those infections are relatively mild, that is not the whole truth: in addition, there are their invisible effects. Every case of streptococcal infection constitutes a centre from which others may be propagated, and so there is, depending upon our success or failure in checking the disease and its spread, an incalculable multitude of consequences, good and evil. It is our duty, therefore, to strain every effort both as practising and as teaching surgeons to work out the best means of controlling it. Furthermore, inasmuch as the hæmolytic streptococcus owns a habitation and finds its greatest field of activity in the throat, nose and ear, so the problem of its control falls to the oto-laryngologist, and it must be admitted that that problem is one difficult of solution. Nevertheless, it is our manifest duty to make the attempt.

We have to combat a ubiquitous and protean organism normally present in our regions, whose habit ranges from perfect innocence to the most deadly virulence; and the change from friendship, or at least neutrality, to enmity may take place overnight. At the present moment we can obtain little help from bacteriological prophylactics. There is no known method of banishing the streptococcus from the throat, and the routine administration of a prophylactic dose of antistreptococcus serum to every patient before operation is out of the question; prophylaxis would be swallowed up in anaphylaxis.

Fortunately, although the hæmolytic streptococcus is a normal inhabitant of many throats, perhaps of all, in numbers small or great, it seems to be, for the most part, non-pathogenic and to remain so even when tempted by a raw, fresh wound, as our experience with the tonsil operation shows us. It is the foreign streptococcus that is most dangerous.

To come to practical politics the proper procedure would seem to be to take a culture from all acute ears, sinuses and throats, and to treat those with the hæmolytic streptococcus as infectious. We might perhaps ask Public Health

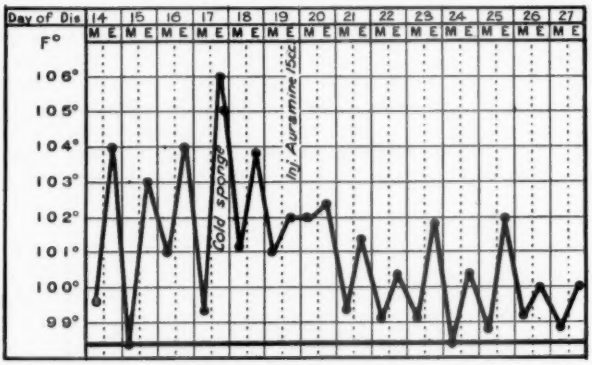


FIG. 2.

Authorities why notification is limited to scarlet fever, erysipelas, and puerperal septicæmia. Should not all streptococcal disease be notifiable? But perhaps this would be rather too tall an order.

Apart from autogenous infection, which I shall deal with in a moment, we have to consider then how to guard against exogenous infection.

In this connection, let me first of all quote a paragraph from Dr. C. C. Okell's recent Milroy Lectures:—

"The care which is taken in modern hospitals to avoid the aggregation of septic streptoccocal cases prevents us from seeing nowadays the natural propagation and exaltation of streptococcal epidemics lamentably common in such institutions during the earlier part of last century. But in one department at least of hospital practice, from causes which are not at all easily controlled, something of the old epidemiological *mise-en-scène* is maintained. I refer to the throat and ear departments of hospitals."—"Even if we exclude the special problem of scarlet fever from consideration, the epidemiological conditions met with in throat wards of hospitals are worthy of more study than seems to have been given to them."

Here is a clear call to us to set our house in order. Let us proceed to do so.

Although it is open to error on the part of the human element, we may, I think, regard the modern operating theatre and all that takes place within it as above criticism in so far as exogenous infection is concerned. But what about our wards?

Should clean operation cases—submucous resections, tonsils, and so on—be warded alongside active streptococcal cases, which as we saw are suffering from infectious disease? I suggest that in view of our present knowledge the two case groups should be separated.

Furthermore, we are compelled also to regard sore throats among the hospital staff as particularly suspect. Here cultural evidence of the hæmolytic streptococcus is important, and should be decisive. Both patients and members of the hospital staff should be warned to report sore throat as soon as they become aware of it, and cultures should at once be made, a positive result leading to the immediate isolation of the infected person. The influence of droplet infection in such cases will be remembered, and the fact that it is air-borne, especially between sleepers in adjoining beds.

All this raises a question too large to be considered here, namely the arrangement of throat and ear wards and hospitals. Obviously, reconstruction and reorganization must follow those discoveries and disclosures. It is a significant fact that in nursing-homes our cases are less frequently attacked by sepsis than our cases in hospital.

We come now to the prevention of autogenous streptococcal infection at operation. In many cases this is most difficult, and it may be impossible of accomplishment. Given a streptococcal mastoid, how can it be opened and drained save through clean and healthy, that is to say unprotected tissues? It will be admitted that operative infection of this clean wound is the rule, not the exception. Erysipelas is doubtless uncommon, but, short of erysipelas, we encounter all degrees and varieties of wound infection, with, usually, more or less pyrexia and some toxæmia during the first week. That surely is unsatisfactory. But can it be avoided?

The first point that has occurred to me is the obvious one that, in operating for acute mastoiditis, the extent of the incision and of the subsequent dissection should conform strictly to the necessities of the case, and should not exceed those necessities. This means that in definitely early mastoids, particularly when virulence is high, a short direct incision down the middle of the subcutaneous area of the mastoid process, and through skin, subcutaneous tissue, and periosteum to bone, will be sufficient to enable us to open the cells. There is no need to carry it any higher than the temporal line, or even as high as that line in many cases. Through this short incision the mastoid can be sufficiently exposed to permit of the removal of the bone necessary to drain the cells and the mastoid antrum.

If anything further is required, then or afterwards, the incision can be extended. But my plea is for a simple incision and a simple operation for drainage of the infected area; this to be the norm.

It is admitted that this partial operation, in which the complete exenteration of the mastoid process is not attempted, will in many cases necessitate another operation at a later date. But what of it? By that time the high virulence of the infection will have subsided under the influence of a free irrigation of the area with blood-serum. And in many cases, on the other hand, no second operation at all will be required.

I may remind you that this procedure is what is recommended in operating for acute frontal sinusitis. There we content ourselves, unless there is some reason to the contrary, with simple drainage to begin with, a wide bone-operation being avoided until the acute stage has passed.

Here perhaps I may say that, with some little experience of mastoid operations in scarlet fever, I agree with T. B. Layton that there are cases in which the simple Wilde incision is of great service. And I ought to add further that the post-operative septic infection of the healthy soft parts is much more frequent and severe in scarlet than in ordinary acute mastoid operations. For that matter, indeed, in the

majority of ordinary acute mastoids the infectivity of the causal organism is so low that it may be held that there is no need for such special precautions as that of limiting the incision strictly to the mastoid process. We may perhaps divide our cases into three classes, in the first two of which only this special care is advisable: (1) scarlet, in which wound-infection is nearly always severe and prolonged; (2) fulminating non-scarlet, in which high temperature and severe pain precede the opening of the tympanic membrane, and wound infection tends to be of the erysipelatous type; and (3) mild non-scarlet, in which wound infection is generally, but not invariably, trifling. Obviously, however, in late mastoid operations, and in the presence of suspected or manifest intracranial complications, the short incision would give insufficient exposure. But apart from that, what objection is there to it? It exposes the minimum of defenceless tissue to the streptococcus, and one can easily reach the antrum and clear out the cells as far as the apex in a very brief space of time. Another device I have been trying is the old-fashioned plan of covering, before the bone is breached, the raw edges and surfaces of the ordinary mastoid wound of access, with layers of gauze soaked in antiseptic solution and held in place with towel-clips. It certainly seems to keep the wounds cleaner, but the more virulent infections defy it; wound suppuration follows in spite of it.

It cannot be denied that in these operations simple general asepsis is insufficient. We are here dealing with a virulent infection from within coming into close and prolonged contact with a newly made wound providing a fresh area for its extension. Does it not seem rather ridiculous to surround the patient and the operated area with all the elaborate paraphernalia of modern aseptic surgery—gloves, masks, sterilized towels, gowns, trousers, shoes and what not, to employ nothing but sterilized instruments and dressings, and then to allow one of the most virulent bacteria known to pour freely over the newly opened tissues? That they came from the patient and not from the surgeon and his instruments, in no way mitigates their power for evil. For, although quiescent autogenous bacteria are mostly harmless, these same bacteria when active are pernicious. The same reasoning applies to nasal sinus operations.

It may be objected that those suggested changes in method are too partial to control so active an infection. It may be so. Nevertheless the laws that govern epidemics seem to-day to be working in our favour. We have quoted J. D. Rolleston's observation of the decline in the mortality of scarlet in the last half century and we may surmise that this general lowering of the virulence is probably affecting other varieties of streptococcus infection no less than scarlet fever. Our methods and the improvement in general sanitation are exercising an effect beyond what had been expected of them. For it would appear that the virulence of pathogenic bacteria declines along with their opportunities. We may, therefore, be able, even by measures admittedly partial, to hasten the day when this menace will be abolished.

Finally, there is this influence of our efforts to reduce the activities of the hæmolytic streptococcus to be considered. One of the serious problems confronting Public Health Authorities at present is the apparently uncontrollable mortality from puerperal septicæmia. How much is due to infection lodged in our regions on the part of patients, nurses and doctors?

I can record a case bearing on this point. A registered midwife was having a number of cases of puerperal septicæmia in her practice. The M.O.H. for the district grew hæmolytic streptococci from her tonsils and she was recommended for tonsillectomy. This was performed and streptococci disappeared from her throat and septicæmia from her practice.

If this were a common source of the infection and if it responded to our therapeutic and preventive efforts, then here, as in tonsil-adenoid disease, the nation would again be indebted to the oto-laryngologist for a great saving of life and health.

APPENDIX.

Erysipelas and scarlet.—According to the unitarian view, erysipelas and scarlet are both caused by the same erythrogenic streptococcus.

Clinically, they resemble each other in more ways than in the similarity of a red rash. Both are followed by desquamation. Both cause septicæmia. Both may arise *de novo* in the course of a pyogenic streptococcal disease, particularly after operation. Both are associated with streptococcal pharyngitis in people around. Both may give rise to puerperal fever.

There are differences however. To begin with, neither confers immunity from the other. I have seen it stated that erysipelas is rare after scarlet. It is not common perhaps, but it does occur. In any case, however, too much must not be made of this objection since the immunity conferred by erysipelas from itself lasts but a few weeks, while relapses and recurrences are by no means uncommon in scarlet, my Public Health friends assure me. Further, as the scarlet streptococcus attacks the pharynx primarily and has but little invasive power, while the streptococcus in erysipelas is primarily cutaneous and manifests great invasive activity, the absence of mutual immunity may depend upon these differences rather than upon any specific and stereotyped differences in the streptococci themselves.

Perhaps each variety represents merely a temporary subspecies evolved by the streptococcus to suit a particular environment.

Discussion.—The PRESIDENT: It has been an unpleasant experience in our department at University College Hospital during the present year to have some of these cases, and I have been personally a victim when, following tonsil operations, a patient acquired a pure *Streptococcus hæmolyticus* infection of a bronchopneumonic kind which ended fatally. My colleagues, with Professor O'Kell and myself, formed a committee and the question is being investigated. Everybody in the department is being examined regularly, and at a later date a report will be presented which should have some interesting bearing upon this subject.

Mr. SYDNEY SCOTT: Those who, for many years, have had wards for acute throat and ear cases have certainly experienced so-called outbreaks of erysipelas. Perhaps they number from three to six cases a year, and perhaps several patients are affected at the same time. The wards may be turned out, disinfected, and so on, then opened again, and perhaps another case of erysipelas occurs almost at once. I have come to the conclusion that there is no specific erysipelas organism; erysipelas occurs when the hæmolytic streptococcus abounds. If it is not due to a specific organism, but to one which has an affinity for the skin of certain patients, then the question of the necessity or otherwise of isolation arises. Cases of erysipelas arise in private nursing homes where conditions are compatible with those of isolation. The mortality was, fortunately, not high. I will cite two cases exemplifying recovery in spite of adverse complication; both cases were for a time in extremis.

One was in an infant eleven months old, under the care of Lord Horder at St. Bartholomew's Hospital. Respirations were 70; pulse 170; temperatures up to 105° for a week. Owing to bronchopneumonia and acute otitis media the outlook seemed hopeless. The house surgeon performed a double mastoid operation (Schwartze) under gas and oxygen. Within a few days the scalp over the parietal bones became swollen and fluctuation was obtainable, but incisions proved that the swelling was due to œdema only, caused by erysipelas which spread over the neck and back. Blood transfusions were given, and though her life had been despaired of, the child has made a perfect recovery.

The other case was one of morbus cordis in an old lady under the care of Lord Dawson. She was suddenly seized with a rigor when shopping, and was taken home in a state of collapse. She had rigors daily for a week, and extreme dyspnœa, and she looked as if nearing the point of death. Her pulse was weak, rapid, and irregular, temperature high, and respirations 30 to 40 per minute. She was too weak to speak, and it was only by routine examination that a quinsy was discovered. It was decided to run all risks. Chloroform was given by a local practitioner as she sat propped up in bed, and I opened a large peri-tonsillar abscess. Facial erysipelas, was evident on the third day, and although so extremely ill she completely recovered.

I do not think that anything we can do will prevent a patient with *Streptococcus hæmolyticus* infection from occasionally developing erysipelas. As regards the mastoid operation, when this is necessary, I believe in opening all the cells, and cannot conceive that the length of incision is of any importance so long as it is adequate to expose the cells.

Mr. W. M. MOLLISON: One point of interest in Dr. McKenzie's paper is that regarding throat infection and puerperal sepsis. I had an interesting case of a dentist who caused scarlet fever. He had a practice in a town and also a branch practice in the country. It was noticed, over a considerable period, that cases of scarlet fever developed in patients from whom he had extracted teeth. At first it was put down to accident or other reasons, then a small epidemic arose in his branch practice and it was evident after a time that the dentist himself was the cause of the scarlet fever. He became much worried of course and consulted a senior colleague who referred him to me. Examination of his throat showed ordinary-looking tonsils. However, after due consideration, it was decided to remove them. They were sent to a bacteriologist who had special experience in scarlet fever and as he reported that the streptococci recovered were those commonly associated with that disease—it is reasonable to consider that the epidemic of scarlet fever was due to the tonsils of the dental surgeon. It should be added that afterwards, the cases of scarlet fever ceased in his practice.

Another thing which has interested me lately, is a particular form of erysipelas seen after mastoid operations; the form that causes œdema of the scalp. I have seen three cases in the last year. The most recent one in my mind which illustrates one or two points that Dr. McKenzie has made. The patient was the mother of a boy who had acute bilateral mastoiditis and on whom I had to operate. He made a good recovery though his was one of the very acute cases due to the hæmolytic streptococcus. While he was convalescing his mother developed acute mastoiditis on the right side. The operation presented no difficulties but after about three or four days her condition was not at all satisfactory. Her temperature kept up and she complained of pain in the opposite mastoid and ear. The tympanic membrane was, however, normal. Next day she complained of tenderness in the scalp and in the occipital region, pitting of the scalp was found; during the next two days more tenderness developed and the whole scalp became œdematous. Not until the fourth day did she develop any sign of true erysipelas; then redness of the skin of the forehead occurred. Recovery followed in a few days. I have seen yet another case where the œdema of the scalp was the only feature of erysipelas.

The third case was that of a man in whom œdema developed all over the scalp; finally abscesses occurred and had to be opened in about five places.

These three cases were undoubtedly cases of erysipelas due to the mastoid infection.

Influence of Unilateral Labyrinth-extirpation in Cats on the Movements of the Alimentary Canal.

By J. W. LE HEUX and A. DE KLEIJN.

IN a previous communication we proved that in cats labyrinth-extirpation is followed by disturbances of the movements of the alimentary canal.

The movements and the emptying of the stomach are chiefly influenced. The influence is somewhat less on the movements of the small intestine and least of all on the large intestine. The disturbances are of a transient nature; in from ten to twelve days after labyrinth-extirpation the movements of the alimentary canal are normal again, but the other phenomena, for instance motor disturbances, are still clearly to be observed.

In a partial operation, in which the bulla ossea is opened, and only the sympathetic nerves of the middle ear are destroyed, disturbances of the alimentary canal do not follow. Disturbances of the alimentary canal appear, however, when, sometime after unilateral labyrinth-extirpation, the other labyrinth is removed. After bilateral simultaneous labyrinth-extirpation the disturbances are almost as strong as those after unilateral-extirpation.

Lately a series of experiments has been made in order to examine the reflex-arcs associated with these disturbances: In the first series of experiments a bilateral vagotomy was performed in cats and after the animals had entirely recovered, the movements of the alimentary canal were examined carefully by X-rays, after the method of Cannon. Some time later unilateral labyrinth-extirpation was performed, and the next day the gastric and intestinal movements were examined once more. In a second series of experiments exactly the same examinations were made, with this difference only, that instead of vagotomy being performed, the sympathetic nerves of the alimentary canal were cut.

Before these results are described the disturbances found after unilateral labyrinth-extirpation are shown in a diagram, for the purpose of comparison (fig. 1).

On the abscissa the time is set out in hours, from the moment in which feeding was finished. The ordinates represent total length of the loops of the small intestine in cm. The horizontal lines underneath the abscissa show the length of time during which there is still food in the stomach. The arrows point out the

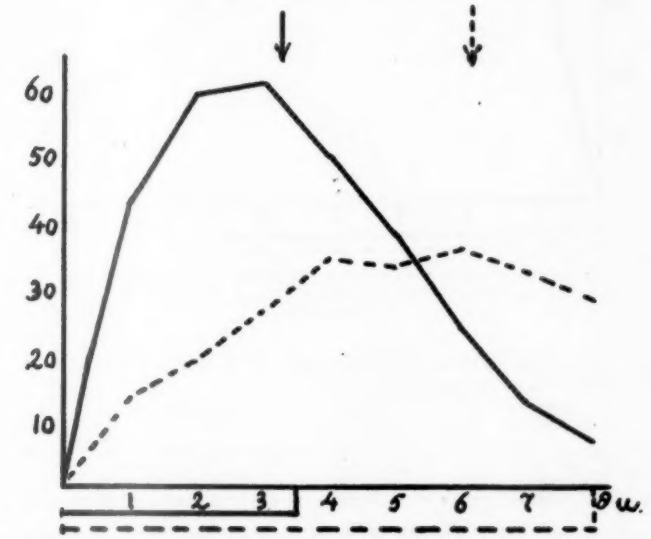


FIG. 1. ——— Average of the records of six normal animals.
- - - - - Average of the records of six animals after unilateral labyrinth extirpation.

moment at which the first shadow is to be observed in the cæcum. The continuous line shows the average of the records of six normal cats; the dotted line shows the average of the records of the six cats after unilateral labyrinth-extirpation.

Renewed examinations gave the following results:—

(1) *The influence of unilateral labyrinth-extirpation on the movements of the alimentary canal in cats after bilateral vagotomy.*

The bilateral vagotomy was performed on four cats under Meltzer-ether narcosis; in two cats (1 and 2 in the table) both vagi were cut near the cardia; in the others (3 and 4 in the table) the right vagus nerve was cut below the branching of the laryngeal nerve in the thorax; the left one was cut in the neck. In all cases not only were the vagi cut, but a piece of the nerve was removed. Apparently it is not

practicable to cut both vagus nerves in the neck, because the unavoidable associated cutting of the recurrent laryngeal nerves causes signs of suffocation.

The results of the examinations in these four cats are shown in fig. 2. The continuous line shows the average of the records of the experiments in animals with a bilateral vagotomy. The dotted line shows the average of the records in the same

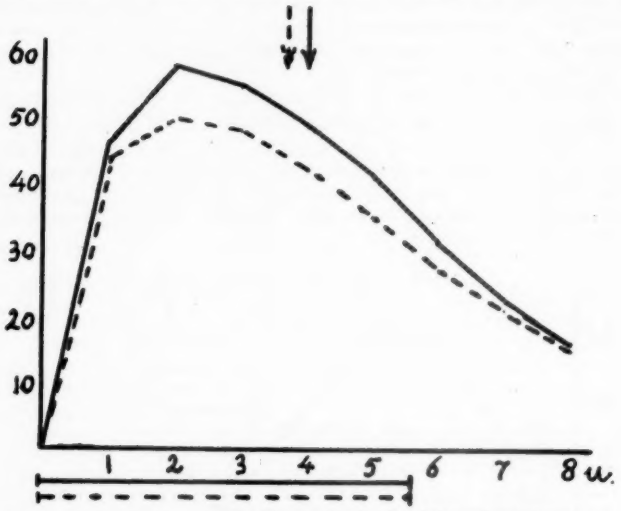


FIG. 2. —— Average of the records of four animals after bilateral vagotomy.
- - - - - Average of the records of the same four animals after unilateral labyrinth extirpation.

animals after unilateral labyrinth-extirpation. The table gives the dates of the various operations and examinations:—

Cats	Bilateral vagotomy	X-ray examinations	Unilateral labyrinth-extirpation	Second X-ray examination
1 ...	9.5.1931 ...	2.6.1931 ...	15.6.1931 ...	16.6.1931
2 ...	23.5.1931 ...	24.6.1931 ...	13.7.1931 ...	14.7.1931
3 ...	15.12.1932 ...	5.1.1933 ...	12.1.1933 ...	13.1.1933
4 ...	7.1.1933 ...	17.1.1933 ...	25.1.1933 ...	26.1.1933

When comparing fig. 1 and fig. 2, it is obvious that after bilateral vagotomy, labyrinth-extirpation exercises no noticeable influence on the gastric and intestinal movements.[1]

The length of time during which there is food in the stomach (line underneath the abscissa) is exactly the same both before and after labyrinth-extirpation. Furthermore, after labyrinth-extirpation, a shadow in the cæcum (arrow) is to be observed in about the same time as before the operation. The filling of the cæcum begins even rather sooner after the labyrinth-extirpation than before. This is not of much importance, especially in view of the fact that the reverse occurred in the fifth case in which the food remained in the stomach during an equally long period.

The curves which point out the total length of the shadows of the small intestine in centimetres show but little difference, even less than would be expected, at the daily variations. On comparing fig. 1 and fig. 2 it is evident that in normal animals

[1] This is in accordance with the experience of Spiegel and Démétriades, who have stated as a result of their experiments, that a double-sided vagotomy neutralizes the effect of labyrinth-irritation on the small intestine. *Mon. f. Ohrhlk.*, 1924, lviii, 63.

the entire curve is changed after labyrinth-extirpation, whereas the curve in the case of animals in which the vagi have been cut after labyrinth-extirpation shows but little change.

(2) *The influence of unilateral labyrinth-extirpation on the gastric and intestinal movements in cats after the sympathetic innervation has been eliminated.*

To eliminate the sympathetic innervation of the alimentary canal from the stomach to the cæcum, the post-ganglionic fibres were cut in their course, after a method elaborated by Langley and Magnus[1] for this purpose.

In their investigations, Langley and Magnus cut the post-ganglionic fibres in their course to some parts only of the alimentary canal. Later on, Magnus[2] made

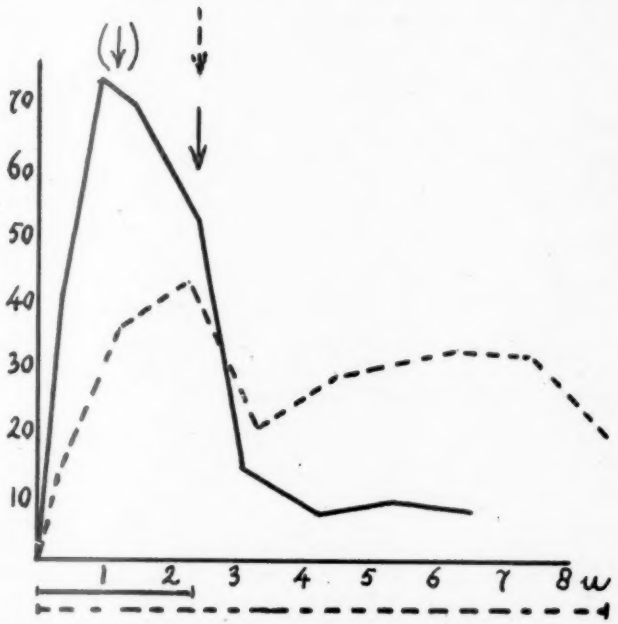


FIG. 3. —— Record after cutting the sympathetic innervation.
- - - - - Record of the same animal after unilateral labyrinth extirpation.

experiments in which the whole innervation from stomach to anus was abolished.

Fig. 3 illustrated one of our experiments.

On February 23, 1932, Professor Bijlsma cut the sympathetic nerves that supply the alimentary canal. The first X-ray examination was made March 17, 1932. One labyrinth was extirpated, April 4, 1932. The animal was X-rayed again, April 5, 1932. When the diagram thus obtained is compared with those of former examinations, it is clearly seen that the curves are quite different.

After cutting the sympathetic innervation, but before the labyrinth-extirpation (continuous line), the stomach is empty in a little more than two hours, whereas the first shadow in the cæcum is noticed after a little more than an hour (↓), and is quite distinct after two hours and a half ↓. After the labyrinth-extirpation the

[1] LANGLEY, J. N., and MAGNUS, R., *Journ. of Physiol.*, 1905, xxxiii, 84.
[2] MAGNUS, R., *Pflügers Archiv.*, 1906, cxv, 316.

conditions are changed entirely. The first shadow in the cæcum is visible after a little more than two hours and a half because of the section of the inhibiting sympathetic fibres, but the stomach remains filled with food for more than eight hours. Whereas the curve which indicates the shadow of the small intestine (- - -) shows the same typical change as the curve on fig. 1 in normal animals after labyrinth-extirpation. Only the beginning of the curve in fig. 3 rises more rapidly than in fig. 1, which, however, is to be expected after the cutting of the inhibiting sympathetic fibres.

We may therefore sum up our results by stating that the cutting of the sympathetic fibres of the alimentary canal does not neutralize the influence of labyrinth-extirpation on the gastric and intestinal movements.

We made two more similar experiments, but did not calculate the average of all three cases, because of the individual differences, shown in the diagrams obtained, after cutting the sympathetic fibres.

In all three examinations, however, the labyrinth-extirpation was followed by a diminished emptying of the stomach, a delayed filling of the large intestine and a typical change in the curve which indicates the total length of the shadow of the the small intestine. Our conclusion, therefore, is that, in principle, exactly the same phenomena were found to occur after labyrinth-extirpation in normal animals, as in animals in which the sympathetic innervation was abolished.

Conclusions.—After labyrinth-extirpation in cats the reflexes which govern the movements of the alimentary canal, pass for the most part or even entirely along the vagi. If both the vagi are cut before the labyrinth-extirpation, the latter operation no longer causes disturbances in the movements of the alimentary canal.

The elimination of the sympathetic innervation of the alimentary canal from the stomach to the cæcum by cutting the post ganglionic fibres in their course, does not neutralize the influence of the labyrinth-extirpation.

Discussion.—Mr. SYDNEY SCOTT: I think Dr. de Kleijn's interesting findings throw light on the occasional occurrence of diarrhœa associated with aural vertigo or Menière's symptom complex. I would like to know if Dr. de Kleijn has ever found any changes in respiration after extirpation of the labyrinth, because in some cases we meet with dyspnœa associated with aural vertigo.

Mr. F. C. ORMEROD: Quite recently a doctor came to consult me because while walking down Wimpole Street after a visit to his dentist he had had a most violent attack of horizontal vertigo; the whole street seemed to move from side to side. He just managed to get into the Underground lavatory at Oxford Circus and there had to stay for three hours (during which time he was very giddy and continuously vomited and passed small motions). With some difficulty he eventually got out and went to the Middlesex Hospital, where bicarbonate of soda and atropine was administered to him. He was afterwards able to return home. These attacks had continued for several days. I found that one Eustachian tube was completely blocked; when this was cleared, the symptoms entirely subsided. In this case the alimentary canal was completely inco-ordinated and working most erratically, and the symptoms appear to have been due to irritation of the labyrinthine system.

Dr. KERR LOVE: I should like to tell you of an experience which occurred a long time ago and which I fancy is associated with the kind of disturbances which have been described by Dr. de Kleijn. At the dispensary of the Glasgow Royal Infirmary, on one occasion a long time ago, I thought it my duty to deal with a piece of granulation tissue in the middle ear and in doing so I removed the stapes. In this case the symptoms occurred in a shorter time than in the experimental work just described. Within ten minutes my patient was on the floor owing to giddiness, and within a quarter of an hour she had to be removed to the lavatory owing to diarrhœa and vomiting—she had to get rid of the contents of the alimentary canal. This was the most striking example of the association of the labyrinth and the alimentary canal which I have seen in my practice.

Dr. DE KLEIJN (in reply): The labyrinth has a great influence on the alimentary canal in man also, but X-ray examination is very difficult. I have not had any definite experience in man, as the patients with sudden loss of function of the labyrinth are too ill to be examined by means of X-rays.

Tuberculous Mastoiditis in Children : Results of Treatment.

By H. ROSS SOUPER, M.D.

IN reviewing the English literature on this subject I have been struck by the absence of any detailed statement or statistics of results, except in McCart's article of 1925 where, however, end-results are mentioned with extreme brevity.

I am able to present a series of 36 cases and, however unfavourable my results may be, I venture to bring them forward.

The cases are from the Royal Aberdeen Hospital for Sick Children, during the eleven years 1922-1932 inclusive. In the North East of Scotland the disease in children is not rare, as these figures show, and I feel certain that there are many others—whom the otologist never sees—treated as cervical adenitis or abscess, the suppurative otitis media being overlooked. In this period I have seen in all forty-two cases (39 in children), but for these statistics I take the 36 treated by myself at the same hospital. I must admit at the start that not all were *proved* to be tuberculous. Up to the spring of 1929 the hospital was housed in old buildings without laboratory accommodation, and as the operations were frequently emergencies, the proper preservation of material for examination was impracticable. Bacteriological or pathological examination was performed in 15 cases with negative result in only two. Animal inoculations were not done. I freely confess that this communication may therefore be judged scientifically worthless, but as all the 36 cases presented history, symptoms and signs typical of the disease, I hope that my figures may be accepted on a clinical basis.

AGE AND INCIDENCE.

No patient was over 6 years of age: 29 were under 12 months, and 17 under 6 months. All were admitted as "acute" cases on account, for example, of mastoid swelling or facial paralysis. (Incidentally, I may remark that mastoid swelling was present in 23 cases, and facial paralysis before operation in 17 and after operation in two.) In the same age-group for the same period were admitted 157 cases of ordinary acute mastoiditis; so that out of a total of 193, 36 were tuberculous—a percentage incidence of 18·65. This figure approximates to Milligan's. (The percentages are not submitted as authoritative, as the total figures are, of course, far too small for that; but expression in percentages is at least convenient.) The cases of chronically suppurating ears admitted for radical operation are not included, as in my series the tuberculous cases are more comparable with the "acute mastoids."

TREATMENT AND RESULTS.

I began my treatment of the tuberculous cases on the principles laid down by authority—principles which have been emphasized, for example, by J. S. Fraser, more than once; namely that operation must be radical and extensive; that bone must be removed widely, the dura of the middle and posterior fossa being exposed, as it affords a better defence against the disease than does bone. I fear I neglected Milligan's warning that while it is necessary to remove bone freely, it may be better to operate in stages. When I took stock of my position at the end of the first five years, I found that in 13 out of 22 cases the patients had died in hospital, i.e. 59%. Of the operations in these cases, 16 were radical (eight of these patients had also

one or more secondary operations) with 11 deaths, four occurring in the secondary operation group (one other patient died from diphtheria three months after operation): six were cortical with only two deaths.

After this stock-taking, therefore, I modified both my principles and my operation. I rarely carried out the complete standard radical operation, generally omitting the meatal plastic and leaving the wound widely open, and, where I thought it justifiable, I performed only the Schwartze operation. In the second period, then, there were two complete radicals, four modified radicals, and five corticals. Two patients had no operation, being too ill to stand it; one of these died, and the other was removed from hospital. In one other case operation was merely the removal of a sequestrum from the middle ear, but proved fatal. In this group I frequently delayed operation in order to permit time to build up the child's resistance, if possible, by open-air treatment, natural and artificial heliotherapy—both local and general—suitable drug treatment and so forth. The occupation of a new hospital early in 1929 was a great benefit in the application of all these measures. Minor operations were, of course, performed as required, e.g., incision of gland abscesses, or Wilde's incision in cases with marked mastoid swelling. In this second group of cases the death-rate was five out of 14—a percentage of 35·7 compared with 59% in the first group. The fact of not operating on two of these 14 cases does not, I think, invalidate the percentage result as these two, if they had been operated upon, would assuredly have died. Still, the total death-rate of the whole series in hospital was exactly 50%—18 out of 36. Three patients died after discharge from hospital; one of these was removed by the parents only three weeks after radical operation; the second died from erysipelas two months after discharge, and the third died after an extensive operation for removal of cervical glands ten months after discharge, the ear condition being then apparently cured.

Prognosis.

Surveying the immediate results of the whole series, can we say definitely that there are any factors which influence the immediate prognosis? We must consider first the causes of death. Those were: tuberculous meningitis in five, post-operative shock in six, general asthenia with local spread of the disease in two, multiple skin abscesses (? generalized tuberculosis) in two, pneumonia in one, erysipelas of face and scalp in one, and miliary tuberculosis in one.

(1) *The age of the patient.*—Sixteen deaths occurred in patients aged under 12 months, i.e., in an age-group of 29 cases; the other two deaths were in patients aged between 12 and 22 months, so that all 18 deaths occurred in patients under 2 years. Although the largest number of cases is found in children under 2 years of age, and on that count alone one would expect the largest number of deaths, it appears to be a justifiable and natural conclusion that the younger the child, the less favourable its chance.

(2) *The previous duration of disease.*—It is impossible to estimate this. Parents of the hospital class are, in some respects, singularly unobservant, and indeed negligent. The insidious onset of the disease may explain so much, but how else can one account for a history of swollen neck glands for weeks or—even worse—of facial paralysis observed and ignored both by parent and by doctor? I am sure, however, that, as in all manifestations of tuberculous infection, the earlier we get the child for treatment, the better are its prospects.

(3) *The extent of disease.*—It does not always follow that the more extensive the disease, the worse the prognosis. For example if we take facial paralysis as indicating extensive involvement of bone, in 19 such cases 10 patients died and nine recovered. Again, 18 cases are noted as showing at operation widespread necrosis, e.g., exposure of dura by disease or sequestrum formation, but only seven of these patients died.

(4) *Delay in operating.*—This cannot be adopted as a principle. I certainly believe that one should not rush to operation in all cases—e.g., the presence of facial paralysis should not be an absolute indication for immediate operation—but just as an occasional case may be lost by delay, permitting a rapid spread of disease, so may a seriously ill infant be saved by allowing time to get it into a fit state for operation. Out of five cases in which I deliberately delayed operation four patients eventually died and I am certain that the fifth was saved only by delay. It is impossible to make any hard and fast rule on this question; each case must be decided on its merits, and the advice and co-operation of the physician are essential here. In the four cases in which the patients died I delayed operation only because the infants were so desperately ill, and early operation would not have saved them.

(5) *Extent of operation.*—Here again each case must be considered on its merits. But I feel sure that in the seriously ill infant as little as necessary should be done at first—establish drainage by Wilde's incision or by a simple and rapid cortical operation—remove loose sequestra—incise gland abscesses. Complete the radical operation later when the patient is fit to stand it. That is to say, operate in stages.

The Follow-up of Survivors.

Eighteen patients left hospital alive and four (to whom I have referred) have died since, though not directly from tuberculous otitis media. Only one cannot be traced, and I have had adequate reports on the other 13 up to January of this year. Several I have seen myself. Seven of these were *proved* tuberculous. Eleven are in good health, with healed wounds and dry ears. Two are in poor health; one aged 8, still has a discharging ear after radical operation, but whereas the discharge was formerly T.B.-positive it has been T.B.-negative since operation. Seven of the 13 had facial paralysis, described now as "slight" in three and "marked" in two. In one of these "marked" cases practically the whole of the petrous temporal was lifted out as a sequestrum at a secondary operation. In the 13 survivors the periods since operation vary from 8½ years to 8 months, and their ages range from 12 years to 1 year and 5 months. Three had radical and three modified radical operations, and six had the cortical; that is, in the whole series, out of 22 radical or modified radical operations, six survive; and out of 11 cortical operations six survive. The most surprising result is that one patient, considered unfit for operation and taken home to die, survives in fair condition fifteen months after discharge from hospital.

Conclusions.

Any conclusions which may be drawn from a series of only 36 cases cannot be submitted as authoritative, but I have formed fairly definite personal views as a result of my experience and I put them forward as suggestions rather than conclusions:—

(1) Tuberculous otitis media with mastoiditis is not uncommon in children aged under 2 years.

(2) It is frequently unrecognized both by parents and by practitioners and the dangers are not appreciated. The mortality is at least 50%. Further education is essential.

(3) The earlier the disease is submitted to treatment, the better are the patient's chances.

(4) The younger the child, the more fatal is the disease.

(5) It is impossible to lay down hard and fast rules as to the most suitable time for operation and the extent of operation. Each case must be considered on its merits and the determining factors in prognosis would seem to be the age and the general condition of the child.

(6) The simpler type of operation, where that appears to be sufficient, gives

the best chance of recovery. Extensive operation, if found necessary and advisable, should be performed in stages. The cortical operation gives a recovery rate twice that of the radical.

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Discussion.—Dr. RITCHIE RODGER: The crux of the question is in Dr. Ross Souper's last sentence, in which he advocates the Schwartze operation in preference to the radical. I think we ought to approach these cases in young children as if they were non-tuberculous: that is, we should not assume that they are tuberculous until, either from the pathologist's report or from further observation, they are proved to be so. When I took up my work at the Children's Hospital in Hull I was informed by the general surgeons who had previously done the work that they had acted on the assumption that practically all mastoiditis in very young children was tuberculous. Now if we approach these cases in that way I am quite sure we shall operate on a great many as tuberculous which are not. Probably Dr. Souper's percentage is quite correct; certainly the ratio of 100% is quite wrong. We prove it by the fact that we get four out of five healing up after the simple Schwartze operation. The general surgeons replied, when I put this to them, that they get healing by first intention in tuberculous joints after excision. But these cases are not analogous at all because when we perform a Schwartze operation on a mastoid which is suspected to be tuberculous, we do not interfere with the original focus of the disease which is in the middle ear, whereas the essential condition for success in dealing with a joint is that the whole of the tuberculous focus must be removed. If we get complete healing after carrying out the Schwartze operation and leaving the middle ear intact, then I think we can assume that we are not dealing with a tuberculous ear.

Dr. DOUGLAS GUTHRIE: Is tuberculous mastoiditis an easy condition to diagnose? When we see a child with otorrhœa of painless and gradual onset, with glands round the ear and perhaps facial paralysis, we say "This is a typical picture of tuberculous mastoiditis," but is it really so? We endeavour to confirm the diagnosis histologically and bacteriologically but we cannot always do so. Formerly one regarded all such cases as tuberculous. In a recent case the only organism we were able to recover was the *Bacillus influenzæ* in pure culture, and the granulation tissue was said to be non-tuberculous. Can Dr. Souper kindly tell us how he verifies the diagnosis?

The ultimate outlook in cases of this nature was formerly regarded as very grave. Many were said to develop tuberculous meningitis and the prognosis was bad even after operation. I recently endeavoured to trace several patients on whom I had operated about twelve years ago. Several had died, but the cause of death was not definitely connected with the ear. Three who came to see me had recovered and were in excellent health. One of them had slight discharge but the others had dry ears. Those cases had been treated, as I treated all tuberculous otitis cases at that time, by the radical mastoid operation. One's attitude towards the problem has entirely changed in recent years because one does not now believe that it is necessary to be radical in operating. I agree with Dr. Souper that one should adopt a fairly conservative attitude towards tuberculosis of the ear. In any case one hesitates to perform the radical mastoid operation on a small child. At the Edinburgh Royal Hospital for Sick Children, we have only performed one radical mastoid operation during the past eighteen months, taking the cases all over, and that was one of extensive cholesteatoma which had already created a "radical cavity." Some of the tuberculous cases do not require operation at all, and many of the patients are so debilitated that it is better for them to have general treatment for a time before operation is performed.

Mr. HAROLD KISCH: I do not think that many of these cases are seen in London. With regard to the facial paralysis I would like to know whether Mr. Souper has made any observations on the labyrinth. If he finds that the facial paralysis is due to labyrinth disease, what does he do?

Dr. C. E. SCOTT: The incidence of tuberculous mastoiditis is still high; I quote the figures for the Children's Hospital for the last few years:—

From 1922 to 1926 we collected a series of 13 cases and from 1928 to the present time we have only had about one case a year, so apparently the incidence is falling in Edinburgh, although the Children's Hospital is not the only hospital in this city which takes in young children.

Mr. F. C. ORMEROD: With regard to Mr. Kisch's question as to facial paralysis; I had several cases which were proved histologically to be tuberculous and in which a cortical mastoid operation was performed, and facial paralysis came on about a fortnight later. All three cases were watched for a week and then as there was no improvement, a radical operation was performed. The facial paralysis began to clear up immediately after operation; I think there is no doubt that it was due to a pathological dehiscence in the wall of the canal.

Dr. ROSS SOUPER (in reply): The whole subject raises a number of questions into which I could not go as the paper is simply the *results* of a series. The curious fact is that the cortical operation is sufficient in many cases when, as is generally supposed, the disease spreads up the Eustachian tube. The first site is in the middle ear and why the simple operation should cure when the middle ear is not touched is rather a mystery to me, except that we are dealing with a large area of diseased bone and probably increase the child's resistance considerably by removal of so much disease and by drainage.

I certainly agree that the type of case described by Dr. Guthrie, with the slow, painless onset, the white flaky discharge, facial paralysis and so on, forms the whole picture and I have been assuming that these cases are tuberculous even where it could not be proved.

Referring to the facial paralysis, I think that is simply from an erosion in the facial canal and not labyrinthine. The application and interpretation of labyrinth tests in a child under one year are rather difficult!

As regards the incidence, there is no doubt that the north-east corner of Scotland is a bad place for all forms of bone and joint tuberculosis and the incidence of tuberculous otitis media I think bears out our unhappy reputation.

Section of Therapeutics and Pharmacology.

President—E. P. POULTON, D.M.

[*November* 8, 1932.]

New Views on the Metabolism of Carbohydrate and Fat and its Relation to Insulin: some Results with the High Carbohydrate—Low Fat Diet in Diabetes.

PRESIDENT'S ADDRESS.

By E. P. POULTON, D.M., F.R.C.P.

(1) A Systematic Error in Calculating the Basal Metabolism.

In order to determine the basal metabolism of a patient, the oxygen intake and the carbon dioxide output are measured before breakfast in the morning, fourteen to sixteen hours after the last meal of the day before; the oxygen intake is converted into calories by multiplying it with a factor which depends on the respiratory quotient. These factors were calculated originally by Zuntz and Schumburg [4], and are based on (1) the heats of combustion of carbohydrate and fat, (2) the chemical composition of carbohydrate and fat, and (3) the theory that, at a respiratory quotient of 1, carbohydrate is alone being oxidized in the body, and, at a respiratory quotient of 0·707, fat is alone being oxidized, and that at intermediate quotients corresponding proportions of carbohydrate and fat are oxidized.

Benedict and Carpenter [1], DuBois and his colleagues [2], and Murlin and Lusk [3], have measured directly in a calorimeter the heat output of a man or animal under basal conditions (direct calorimetry), and have compared this with the heat output calculated on the Zuntz-Schumburg theory from the oxygen and carbon dioxide, which were measured simultaneously (indirect calorimetry), and have drawn the conclusion from average values that agreement between the two was sufficiently satisfactory, and justified the theory on which indirect calorimetry was based.

However, from time to time various doubts have been raised as to the correctness of the Zuntz-Schumburg theory. Benedict and Carpenter, when describing their observations after a meal of carbohydrate, state that in many instances the agreement between direct and indirect calorimetry was extremely unsatisfactory because of the abnormal conditions which were obtained when excessive amounts of carbohydrate were ingested. Such an argument is difficult to follow. Primitive man must often have gorged himself on honey found accidentally, while we learn from the New Testament that locusts and wild honey were a recognized, though meagre, type of diet. It has been known for a long time that respiratory quotients over 1 may be obtained after giving sugar, and these high values must mean the conversion of carbohydrate into some material containing a smaller percentage of oxygen, and in animals the conversion of carbohydrate into fat has been accepted

for a long time. It is difficult to imagine that this conversion begins just at the point when the respiratory quotient reaches the value 1, and that the oxidation of fat stops at exactly the same point. Cathcart and Markowitz [5] have pointed out this difficulty, but their observations on the rise of blood-sugar, respiratory exchange and respiratory quotient, after giving carbohydrate, though suggestive, do not prove that the conversion takes place below a respiratory quotient of 1. They state, "We do not wish to cast doubts on the validity of calculations of indirect calorimetry when the experiments extend over several hours; indeed we are whole-hearted believers in the method under these conditions. We even believe that when conditions in the body are stabilized (as they presumably are in the post-absorptive condition when basal metabolism rates are commonly determined) agreement between indirect and direct calorimetry will be close. But where metabolism is actively proceeding in the organism, as may occur in short experiments following food, this close agreement cannot be expected."

Krogh and Lindhard [6] go further than Cathcart and Markowitz when they suggest that the conversion of carbohydrate to fat on the one hand, and of fat to carbohydrate on the other, begins towards the middle range of respiratory quotients, i.e., in the first case at about 0·9 upwards, and in the second from 0·8 downwards; but it is difficult to see how any argument can really be based on observations in which the heat itself was not directly measured. Further, the diets used to produce high and low respiratory quotients were not strictly comparable because the high carbohydrate diet must have contained much less protein than the low fat diet.

The two reasons that led T. W. Adams and myself to examine the published figures afresh were (1) that Dale and his co-workers [23], and C. F. and G. T. Cori [17] considered that insulin causes oxidation of carbohydrate, while in a depancreatized dog the power to utilize carbohydrate must still be present, because reasonably high respiratory quotients are sometimes obtained; (2) that in the more severe forms of muscular work respiratory quotients above 1 have been observed, which must mean some change of carbohydrate towards fat; but this would be very unlikely if carbohydrate was the main source of energy in muscular work, a hypothesis that has sometimes been put forward to explain quotients up to 1 which were obtained when the muscular work was of moderate intensity.

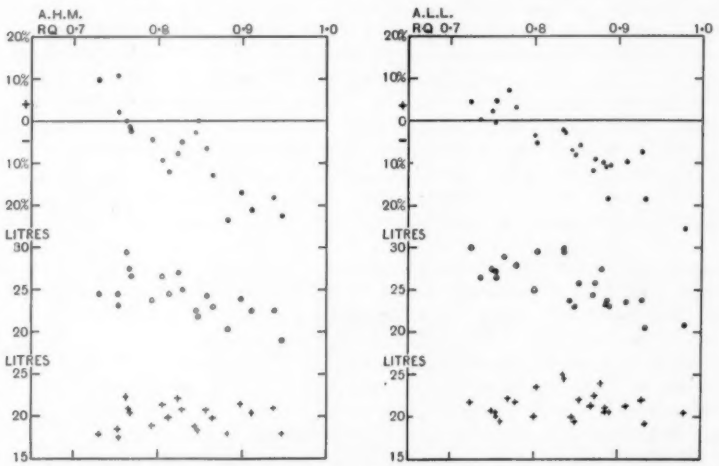
My thanks are due to Mr. Adams for allowing me to describe in this address much of our unpublished work.

The most complete study of direct and indirect calorimetry in normal man has been made by Benedict and Carpenter [1]. In two of their subjects, A.H.M. and A.L.L., the intake of oxygen and output of carbon dioxide and heat were measured with the subject at perfect rest, and in the fasting condition over periods of eight hours for a number of days, and since each eight-hourly period was divided into four periods of two hours each we have twenty-one and twenty-four different sets of observations to deal with. Non-protein values were calculated on the usual assumption that the nitrogen excreted during a period corresponds to an amount of protein that has been completely oxidized during the period; if, now, the carbon dioxide, oxygen and Calories resulting from this oxidation are deducted from the total figures, the remaining carbon dioxide, oxygen and Calories must be due solely to the metabolism of carbohydrate and fat. Richardson [8] gives the method of calculation in a convenient form. Recent analysis, however, makes it very doubtful whether this method of calculation is justified. Still it makes no difference to the argument whether figures without deduction (protein values) or figures after deduction (non-protein values) are used; we have used the latter because this is the general custom at present.

In our preliminary communication [7], in which the subjects A.H.M. and A.L.L. were dealt with, the non-protein Calories calculated from the oxygen and respiratory quotient by the Zuntz-Schumburg method were compared diagrammatically with the

non-protein Calories actually measured (direct calorimetry) at corresponding respiratory quotients, and serious discrepancies were found. For the sake of clearness these diagrams are reproduced here (figs. 1 and 2). The method of comparison is also shown in a new diagram (fig. 3) which contains the findings in subjects who were investigated in the bed or chair calorimeter at Boston in 1908-1911 [1]. In these figures the abscissæ represent the respiratory quotients, and the horizontal line at zero, in the upper part of the figure, the measured heats. The dots are the differences between the calculated and measured heats expressed as percentages of the latter.

Satisfactory agreement between direct and indirect calorimetry would necessitate the points lying more or less evenly above and below the black line throughout the range of respiratory quotients. Obviously this is not the case. For lower quotients



FIGS. 1 and 2.—Comparison of indirect and direct calorimetry. O = oxygen; + = carbon dioxide, two hourly determinations during first day of fasting. Subject at rest. In fig. 1 two observations coincided and so only 20 are shown.

(From the "Proceedings of the Physiological Society," October 22, 1932, *Journ. Physiol.*, lxxvii. By courtesy of the University Press, Cambridge.)

the calculated heats are too high; for higher quotients they are too low. In the experiments on A.H.M. and A.L.L. it was found that the calculated and measured heat only agreed at a respiratory quotient of about 0·785; this represents a combustion of carbohydrate to fat in the ratio of 1 to 1·36. The Zuntz-Schumburg method of calculating the heat gives erroneous results except at this particular point. Now it is unlikely that there can be much error in the first two factors on which this theory is based, viz., the heat of combustion and chemical composition of carbohydrate and fat; therefore it is in the third factor that the error must lie. This means that it is not possible to calculate from the respiratory quotient the proportion of carbohydrate to fat that is actually burnt.

When these results were first reported at a meeting of the Physiological Society, Professor Benedict suggested that they were due to errors in measuring the oxygen. For instance, if the volume of the oxygen were too low the calculated value for the heat would be too low and at the same time the respiratory quotient would be too

high so the point would fall low down to the right of the diagram. Similarly if the oxygen was too high the point would be high up and to the left; in fact the distribution would be the same as in the figures. The oxygen would be particularly liable to error, because it was measured both by noting the loss in weight of a cylinder, and also by determining the change in the oxygen content of the calorimeter

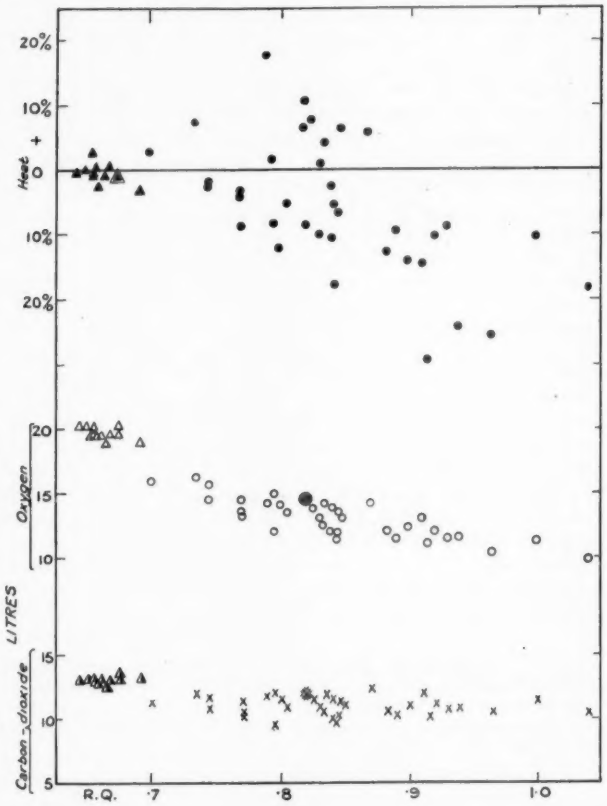


FIG. 3.

● = percentage differences between calculated and measured heat.
▲ = values obtained from burning alcohol in the calorimeter.
△ = oxygen } alcohol checks.
▲ = carbon dioxide }
O = oxygen } values during the first day of fasting calculated per hour.
× = carbon dioxide } Subjects at rest.

Appropriate symbols are used when two or more observations coincide. In all these experiments the measured heat has been corrected both for change in body weight and body temperature.

at the beginning and end of the experiment. Error due to gas-analysis would be magnified in the final result if the volume of the calorimeter was large. The carbon dioxide which has only a small influence on the final result, was presumably accurate, because as the calorimeter was a closed circuit, it could not escape. The truth of

this explanation can be best tested by noting the extent of the variation in the volume of the oxygen which was for A.H.M. from 29·4 litres at a respiratory quotient of 0·762, to 18·9 litres at a respiratory quotient of 0·9475, and for A.L.L. from 30·1 litres at a respiratory quotient of 0·834, to 20·6 litres at a respiratory quotient of 0·9325; these variations are much outside any possible error due to analysis.

This fact is confirmed by control experiments in which alcohol was burnt in the calorimeter and the measured heat, carbon dioxide and oxygen were compared with the quantities predicted from the known weight of alcohol burnt. These controls [9] were so satisfactory that it was only felt necessary to give one typical experiment and a summary of the results of all the experiments of the same type which were made between October 1903 and April 1904 with the large calorimeter of 5,000 litres capacity at the Wesleyan University, Middletown. Nevertheless, in view of the possibility of the large size of the calorimeter influencing the oxygen values the results obtained with the Boston calorimeters have been chosen for presentation in fig. 3. The capacities of the chair and bed calorimeters at Boston are 1,400 and 950 litres respectively. A further number of alcohol checks have been published [10] for these two calorimeters and the results are shown on the left of fig. 3 plotted on the same scale as for the subjects. The spread of the points indicates the extent of the experimental error; the right hand triangle falls below the others because the oxygen is too low; this, as already explained, has the effect both of raising the respiratory quotient and diminishing the calculated heat, and so causing a slope downwards to the right; but the scatter of the points is minute when compared to the results on man. Since experimental error cannot account for the remarkable difference between the calculated and the measured heat there must be some biological cause.

In figs. 1-3 the carbon dioxide and oxygen values have also been plotted; the carbon dioxide remains remarkably constant throughout the range of respiratory quotients; the oxygen diminishes as the respiratory quotient rises. Benedict and Carpenter comment on the constancy of the carbon dioxide in their experiments. The amount of the variation in the oxygen is well outside any possible experimental error as can be seen on the left of fig. 3, where the values for the oxygen and carbon dioxide in the alcohol check experiments have also been plotted to show the size of this error.

It might be objected that the calorimeter was too slow in taking up the heat, and that this accounted in some way for the discrepancy between the calculated and the measured heat because the periods in the various published experiments were too short (1 to 3 hours). This point has been investigated for the subjects A.H.M. and A.L.L. in fig. 4 by plotting the percentage differences between calculated and measured heat for successive periods in the different experiments with the corresponding respiratory quotients underneath. There is a remarkable parallelism between the two curves; if the variation in the top curve were due to lag, why should it be parallel to the respiratory quotient curve which is obtained from oxygen and carbon dioxide quite independently of the measured heat?

In fig. 5 some very extensive observations by Benedict [11] on the first day of fasting of the subject S.A.B. have been plotted. Four different fasting experiments of four, five, seven and four days duration were carried out on this man. The first of these experiments has not been included as the patient was ill during his fast and it was stopped after four days; but all the other two-hourly observations are plotted during the night and day. These experiments differ from those shown in figs. 1-3, because though the patient was resting most of the time, on occasions he moved and walked about in the calorimeter. A precise diary with an account of his actions was kept by an observer outside the calorimeter except at night when S.A.B. pulled the curtains in front of his bed, and was no longer visible. The results are plotted on a smaller scale than in fig. 3 and they are more irregular; but there is obviously the same tendency; at high quotients the calculated values for the heat

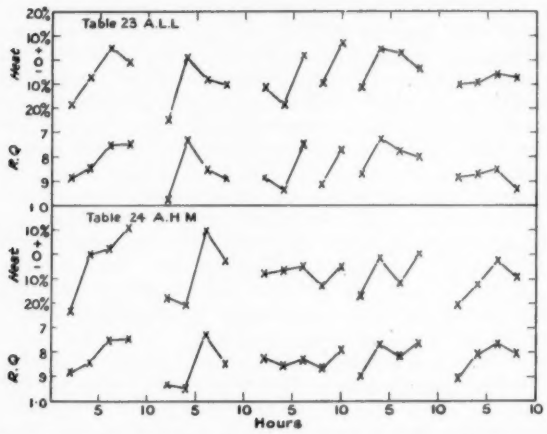


FIG. 4.—The upper figures in each series show the percentage heat differences in succession two, four, six and eight hours after commencement of the experiment; the lower curves indicate the corresponding respiratory quotients. (Tables 23 and 24, Carnegie Publication 261.)

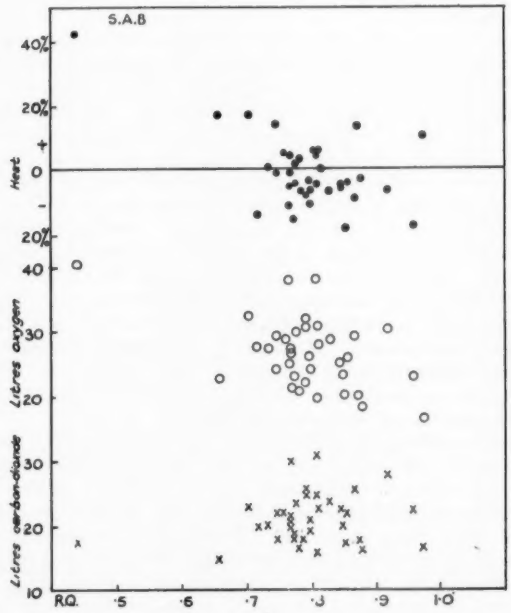


FIG. 5.

● = percentage heat difference.

○ = oxygen
× = carbon dioxide
} two hourly determinations during the first day of each of three fasting experiments of five, seven and four days' duration, respectively.

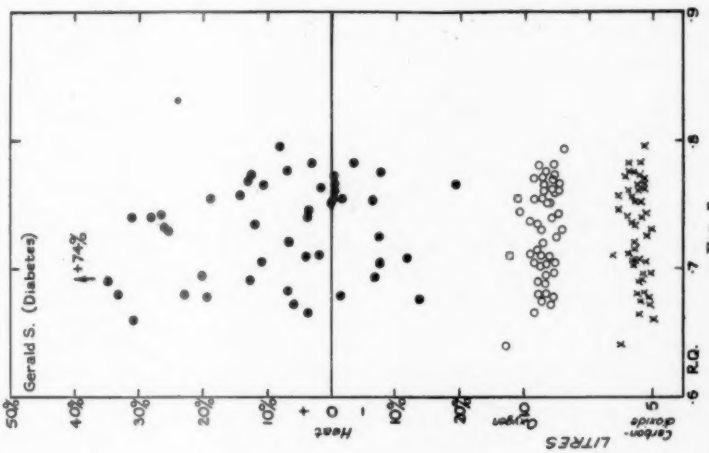


FIG. 7.

● = percentage heat difference. (One difference, not shown, was + 74%.)
O = oxygen } hourly values.
× = carbon dioxide }

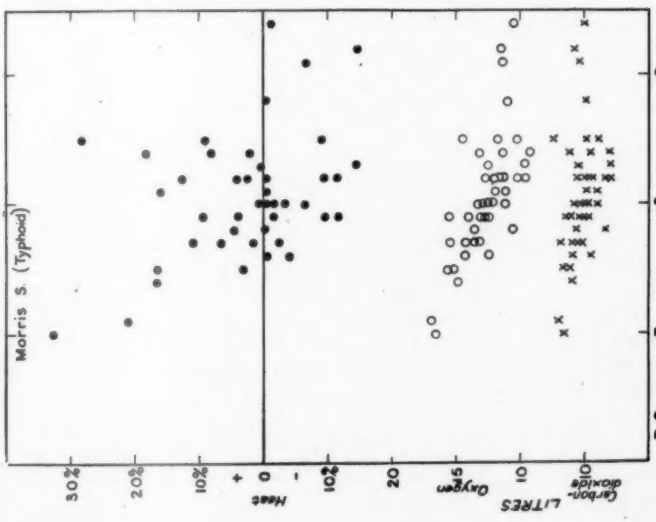


FIG. 6.

● O × = percentage heat difference.
O = oxygen } hourly values.
× = carbon dioxide }

are too low, at lower quotients too high. This series is of particular interest because it includes a value for the respiratory quotient of 0·44 for the 3 to 5 p.m. period of the first day of the seven day experiment; this result would ordinarily be considered incorrect because it is impossible on the Zuntz-Schumburg theory unless it is allowed that fat was being converted into carbohydrate. But the percentage difference at this abnormal quotient falls into line with the others; the calculated heat is 42% greater than the measured heat at this quotient, and this is in a marked contrast to the quotient of 0·96 where the calculated heat is 19% below the measured heat; this quotient also falls into line. [In calculating the heat at respiratory quotient 0·44 the value 4·435 Calories per l. oxygen has been used, obtained by extrapolation of the Zuntz-Schumburg relation between respiratory quotient and Calories per l. oxygen, as given by Lusk [8]. If the value at respiratory quotient 0·707 had been used a still more discrepant result would have been obtained.] The two positive errors at the quotients 0·87 and 0·97 were obtained during the night period when the patient was not being observed; but there does not seem any reason for excluding them. The oxygen and carbon dioxide also behave as in fig. 3; but the results are more variable as would be expected from the varying activities of the patient. It is of great interest that the oxygen for the low quotient has the high value of 40 litres in two hours while the values at the highest quotient are in the neighbourhood of 20 litres. As in fig. 3 the carbon dioxide for the low quotient is very near to that for the highest quotient of all.

Besides examining the metabolism experiments on normal individuals the pathological cases investigated by DuBois and his colleagues in the Russell Sage laboratory of Cornell University have also been re-examined. In all these cases results similar to those of Benedict and Carpenter have been found, and the alcohol checks were even closer than those of Benedict and Carpenter. The diseases which have been re-examined are typhoid fever, exophthalmic goitre, cardiac and renal disease, pernicious anæmia and diabetes.

Diagrams illustrating the results on single patients suffering from typhoid [12], diabetes [13], and exophthalmic goitre [14] are shown in figs. 6, 7, and 8. In fig. 6 the results for typhoid resemble in a general way those of Benedict and Carpenter; the percentage differences fall on a similar slope; at a respiratory quotient of about 0·82 there is no difference between calculated and measured heats; the carbon dioxide at the higher and lower quotients remains about the same while the oxygen falls as the quotient rises. In fig. 7, for the subject Gerald S. with diabetes, the respiratory quotients all fall within a narrow range; the percentage differences are extremely variable—from + 74% to − 19·5%. These variations are quite outside any possible experimental error as shown by the alcohol checks for the calorimeter which are plotted in fig. 8 [15]; possibly in fig. 7 there is a tendency for the difference to be positive at the lower quotients and negative at the higher quotients, but as the range of respiratory quotients is so small it is impossible to be certain about this. The carbon dioxide and oxygen for this subject are remarkably constant, just like the alcohol checks. Here is evidently an ideal subject for a metabolism experiment, the analytical results have the stamp of accuracy; but the method of calculating the heat is grievously at fault.

In fig. 8 the case of exophthalmic goitre presenting the largest number of analytical data is presented, with the alcohol checks on the left hand side of the figure to show the probable range of error. The error in calculating the heat is again obvious.

When it was clear that the Zuntz-Schumburg theory was no longer tenable, it became necessary to see if there was any other relation between carbon dioxide, oxygen, and heat, which would make it possible to calculate the heat if the oxygen and carbon dioxide were given, in other words, Is indirect calorimetry a possibility? The simplest plan was to plot the carbon dioxide and the oxygen independently

against the heat and see if there were any direct relation. It is too early at present to publish a complete study of the question; but the main result may be given in a preliminary form. Determinations from eight individuals in Tables 23 to 26 of Benedict and Carpenter's publication [1] have been plotted in fig. 9, Calories per hour against carbon dioxide per hour on the left and Calories against oxygen on the right. Whereas there is a linear relationship between carbon dioxide and Calories, hardly any such relationship exists for oxygen and Calories. For instance,

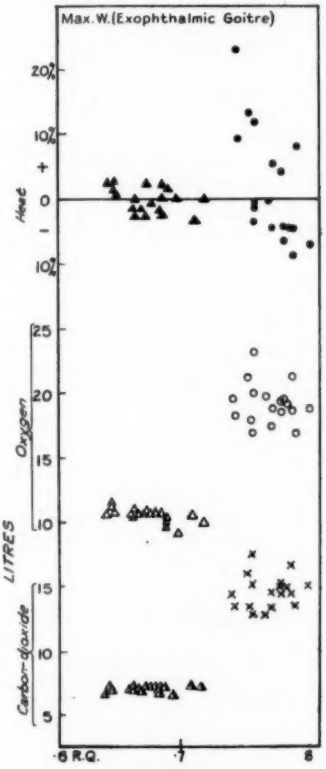


FIG. 8.

● = percentage heat difference.
▲ = values obtained by burning alcohol in the calorimeter.
△ = oxygen } alcohol checks.
◭ = carbon dioxide }
○ = oxygen } hourly values.
× = carbon dioxide }

at 70 Calories the carbon dioxide varies between 10 and 12·2 litres per hour, while the oxygen varies between 10·4 and 15·5, more than twice as much.

Clearly a much closer approximation to the heat will be obtained from the carbon dioxide than from the oxygen. That this extreme variation in the oxygen is not due to casual errors of analysis is shown by the published figures for the alcohol checks, which are shown by the triangles. The variation of the oxygen is no

greater than the variation of the carbon dioxide. The dotted line in the left hand part of fig. 9 is the average slope of the Calorie carbon-dioxide curve (non-protein values) determined from inspection for all published adult cases, normal and pathological, leaving out of account diabetes where the slope and position of the points appear to be quite different and suggest perhaps a different type of metabolism.

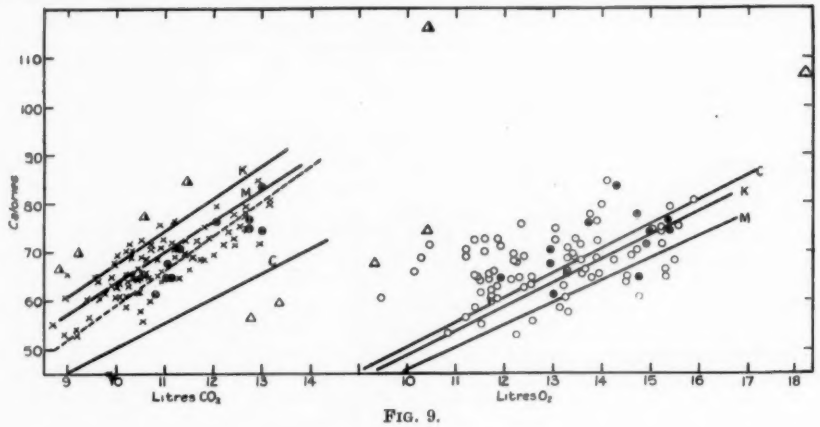


FIG. 9.

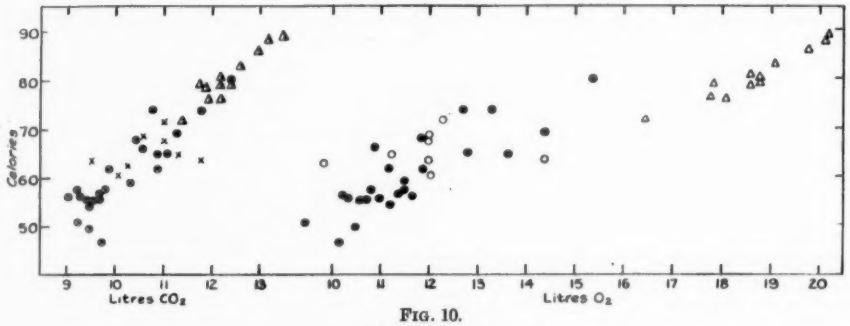


FIG. 10.

FIGS. 9 and 10.

△ = oxygen } values obtained by burning alcohol in the calorimeter.
▲ = carbon dioxide }
○ = oxygen.
× = carbon dioxide.
● = oxygen } values when the heat was not corrected for change in
⊗ = carbon dioxide } body temperature.
[For explanation of lines *see text*.]

The series of results on basal metabolism in fig. 9 are, in our opinion, the fullest and best for normal subjects so far published, for not only has the accuracy of the calorimeter been determined, but with few exceptions the measured heat has been corrected for changes both in body temperature and body weight between the beginning and end of each period of the experiments; changes which involve the absorption or the evolution of heat depending on the specific heat of the tissues of the body. It is clear that when the heat is to be predicted from the respiratory

exchange the carbon dioxide should be used rather than the oxygen, and since the protein metabolism is not usually determined, it would be better to use the relation Calories/carbon dioxide without deductions for protein (protein values). This average relation for the eight subjects of fig. 9 has been found by inspection to be given by a line joining the points 15·5 litres carbon dioxide, 93·4 Calories, and 11 litres carbon dioxide, 68 Calories. We are not prepared to say at present whether it would be safe to extrapolate. King uses carbon dioxide as a measure of heat.

In fig. 10 are plotted the observations on one individual made with the chair and bed calorimeters at Boston—the alcohol checks obtained with these calorimeters are included in the figure. With this subject only a few determinations were corrected for body temperature; but this fact will not account for the greater spread of the oxygen values in contrast to the carbon-dioxide figures. The spreads of the oxygen and carbon dioxide values of the alcohol checks are about equal to one another.

It has been pointed out that the respiratory quotient is not determined by the proportion of carbohydrate and fat being burnt, as would be the case on the Zuntz-Schumburg theory; instead, we have put forward the view that carbohydrate and fat are burnt in a constant ratio. The data in fig. 9 support this view. The line C represents the relation of carbon dioxide and oxygen to Calories if carbohydrate is alone burnt, using Lusk's value for carbohydrate (1 litre of oxygen and carbon dioxide equivalent to 5·047 Calories). The lines K and M represent the same relation for two samples of human fat from skeletal muscle and liver analysed by Cathcart and Cuthbertson [16]. These particular fats were chosen because they represent extremes, and the lines for the other nine human fats analysed by them should lie between these two. On the carbon dioxide diagrams the three lines lie far apart, and the determinations are more or less parallel to them but nearer the fat lines than the carbohydrate line, suggesting that under basal conditions there is a constant combustion ratio, and that a larger proportion of fat than of carbohydrate is burnt. On the oxygen diagram the lines lie much closer together: the determinations lie mostly outside them, suggesting that the oxygen gives no indication as to how carbohydrate and fat are burnt. Presumably the reason is that much of the oxygen is absorbed or given out in collateral processes of partial oxidation and reduction, while the carbon dioxide results only from complete oxidation. It should be noted that though the spread of the carbon dioxide is much less than the oxygen, it is still much outside experimental error. Is it possible that it is due to a variation in the type of fat which is being oxidized?

In concluding this section of my address, I would express my thanks to the Medical Research Council, and the Parsons Fund at Guy's Hospital, for defraying certain expenses incidental to this study.

(2) Action of Insulin on Metabolism.

Up to the present the Zuntz-Schumburg theory has been applied to elucidate the action of insulin in experiments on the respiratory exchange. For instance, Cori and Cori [17] in their work on rats, looked on a rise in respiratory quotient as due to a combustion of carbohydrate, and since insulin with carbohydrate caused a bigger rise of quotient than carbohydrate alone, they drew the conclusion that insulin increased the combustion of carbohydrate. The amount of carbohydrate oxidized calculated on this basis, plus the amount laid down as glycogen, was always lower than the amount absorbed from the intestine during the experiment, although the discrepancy was not much greater than 10%; this might be considered within the limits of experimental error. No evidence was brought forward that there was a systematic error leading to a loss in estimating glycogen; if the errors were merely casual the values should not be consistently too low; they should vary on each side of the amount of sugar actually absorbed.

Cori and Cori also suggested that there was "a possible slight inaccuracy of the Zuntz-Schumburg formula" and the discrepancy is best explained along these lines.

When a dose of insulin with sugar is given to a healthy man it would be expected *a priori* that the metabolic effect would be qualitatively the same as if the sugar was given alone, for it is now generally agreed that a dose of sugar stimulates the production of insulin which is responsible for the fall in blood-sugar after the peak of the curve has been reached. Hence the administration of insulin beforehand merely accentuates what is a normal process. The first problem is to consider what happens when sugar is given alone to a healthy person. Cathcart and Markowitz have pointed out that because the respiratory quotient reaches a value above 1 in such a case, giving sugar cannot merely increase the amount of carbohydrate burnt; there must be some collateral change of carbohydrate into some less oxygenated form. The same thing follows from Benedict and Carpenter's calorimeter results after giving carbohydrate. A mere increase in carbohydrate burnt will not account for the heat actually measured, though the exact nature of the collateral change must be left an open question for the present.

Apparently only one investigation has been made of the effect of insulin on the respiratory exchange and heat directly measured, viz., that by Dann and Chambers on one dog [18]. The results are not entirely satisfactory as the conditions were variable. Sugar was given (*a*) after a period of fasting (three experiments), (*b*) after a period on a maintenance diet (two experiments), (*c*) insulin with sugar was given after a period of fasting (three experiments); but one of the (*a*) and (*c*) experiments took place on the day immediately following a sugar experiment and so the results are more comparable to the maintenance diet experiments and they have been counted as such in the following table; then again the basal values for oxygen, carbon dioxide and heat were rather variable. The differences between the values before and after sugar and before and after insulin with sugar are given in the table. Values for protein are not deducted.

		Increase of carbon dioxide grm.	Increase of oxygen grm.	Increase of Calories	
Fasting experiments ...	(1)	0·72	0·65	3·42	after 50 grm. glucose alone
	(2)	0·82	0·43	3·58	" " " "
	(3)	1·07	0·84	5·7	" 50 grm. glucose and 20 units insulin
	(4)	0·89	0·91	2·55	" " " 60 "
Experiments on ...	(5)	1·11	0·52	3·7	" 50 grm. glucose alone
Maintenance diet ...	(6)	1·15	1·04	5·49	" " " "
	(7)	1·14	0·93	5·95	" " " "
	(8)	1·31	0·61	7·72	" 50 grm. glucose and 20 units insulin

Comparing now the experiments (5 to 8) on the maintenance diet with the fasting experiments (1 to 4) there is certainly a bigger output of carbon dioxide and heat on the maintenance diet, the oxygen is more doubtful. This result is of interest in connection with the first part of this address because it means that after fasting more of the sugar is retained in the body and less is got rid of by oxidation, a wasteful process; this is to be expected. Comparing sugar and insulin (3, 4, 8) with sugar alone (1, 2, 5, 6, 7), insulin does cause an increase in the carbon dioxide and heat, both in fasting and on the maintenance diet. Again the oxygen is doubtful; the bigger values with sugar and insulin after fasting (3, 4) may be due to the fact that the basal values were much lower in these two experiments. If an increase of carbon dioxide means increased combustion, the fact that there is no accompanying increase of oxygen must mean that the oxygen has been supplied by the body; i.e., that the carbohydrate is converted into some less oxygenated form. These two processes take place after sugar alone, but are intensified by giving insulin with the sugar. Hence insulin is responsible for both the processes. This probably accounts for the discrepancies in the experiments by Cori and Cori: the lost glycogen must have been converted into some less oxygenated substance.

(3) The High Carbohydrate—Low Fat Diet in Diabetes.

On February 10, 1931, I opened a discussion held by this Section on "The use of high carbohydrate diets in the treatment of diabetes" [19]. Evidence in favour of the treatment was obtained from a study of 27 insulin patients including seven children, who had either been treated for an average period of over four years with a low carbohydrate diet which was increased subsequently or been given from the beginning a higher carbohydrate diet. The higher carbohydrate diets had been taken in the case of the 20 adults for sixteen months (average), and in the case of the seven children for seventeen months (average). These cases were compared with a group of 24 insulin patients who had been treated with a low carbohydrate diet for periods varying between eleven and forty months. The conclusion was drawn in the case of the adults that the course of the disease was no more unfavourable with higher carbohydrate diets than with low carbohydrate diets while in children there might even be some improvement. Of the 20 adults the daily carbohydrate was in one 100 grm. a day; in 10 cases it was between 100 and 200 grm.; in 8 cases, it was between 200 and 300 grm., and in one case over 300 grm. On the whole the children had more carbohydrate than the adults. The fat varied from 162 grm. in the case where 100 grm. carbohydrate was taken, to 109 when over 200 grm. carbohydrate was taken; the calorie value was about 2,000, though for one large man it was 3,040.

It was pointed out that the insulin was best given up to an hour or more before the meal, and the ratio of carbohydrate to insulin was higher than with the low carbohydrate diets. A series of diet tables was published from which it was possible to choose for a given calorie value any ratio between the carbohydrate and fat in the diet; all the present work has been done by means of these tables.

"*Higher*" *carbohydrate diets.*—The results of further treatment along these same lines will first be considered. Since the carbohydrate-insulin ratio is always increased when more carbohydrate is given, the daily dosage of insulin, which is necessary to keep the blood-sugar normal, will be the best criterion of the continued success of the treatment. Seven of the previous patients have been treated on the high carbohydrate—low fat diet to be considered later; two other patients are not available, one of them in Ceylon and one not heard of; one new patient is included so that the total number is 19; this number includes three children of the previous series, two of whom are now grown up (one an undergraduate at Oxford).

The case Lew., a medical man, was previously commented on as a mild case; his insulin was omitted in June, 1930; since then he has taken ordinary food, but not much actual sugar which he finds always causes temporary glycosuria. His daily carbohydrate is about 150 grm., rather less than when he was taking insulin. His weight has varied between 152 (in 3.33) and 145 lb., and he says he now feels altogether better than at any time for the past seven years. Three sugar tolerance curves have already been given. A fourth on March 17, 1933, rose in 62 min. to 210 mgm., in 90 min. to 190 mgm. His increase in weight may account for the last curve being a little higher than the previous two curves; he has been advised to take less fat. He has done excellently.

The remaining eighteen cases (Table I) are divided into the two groups of the previous communication; in Group 1 insulin treatment had been begun on a diet of low carbohydrate which was afterwards increased; in Group 2 a higher carbohydrate diet was used from the beginning. The first line (in both tables) gives the latest information when the cases were previously reported; the age column refers to this date. Unless otherwise stated, the diet had been taken for some months before the given date, and the method of predicting the body weight was as previously described.

In six of the 18 cases the carbohydrate has been considerably increased since then; of these, in Case V the insulin requirement has been increased, which may be

correlated with the increase of 11 lb. in body weight; in Cases I, IV and X the insulin requirement is about stationary; in Cases VIII and IX there has been a marked decrease: in the latter case, which was not previously reported, there was a 6 months' history with recent thirst. Of the other 12 cases, where the carbohydrate in the diet has not been increased, nine have remained stationary as regards insulin requirement; in two (Cases XVI and XVII) there has been marked improvement. In one (Case XI), where less carbohydrate and much more fat is now being taken, the insulin has increased slightly—22 to 28; owing to the change of diet this case is

TABLE I.

Group 1.

Case	Sex	Age	Date	Naked Wt. lb.	Range of predicted Wt. lb.	Diet C.	F.	P.	(Cals.)	Period on diet, months	Insulin	C./Ins.
1 Le.	M.	57	2.31	145	137-204	100	162	104	2,340	11	44	2·3
			11.32	144*		190	105			21	42	4·5
2 M. Sm.	M.	43	1.31	140	99-161	145	145	94	2,330	12	30	4·8
			11.32	143*		,,				22	28	5·2
3 Ett.	M.	41	3.31	123	103-154	139	149	83	2,300	16	42	3·3
			11.32	126		,,	,,	,,	,,	20	40	3·5
4 Osb.	F.	41	10.30	143	102-150	105	156	77	2,200	19	65	1·6
			10.32	133		160				24	64	2·5
5 Bai.	M.	35	3.31	190	120-180	115	141	108	2,230	26	66	1·7
			11.32	201		150	75	70	1,600	20	88	1·7
6 Cre.	F.	33	2.31	117	118-175	248	133	77	2,570	24	24	10
			11.32	121		240	95	78	2,185	21	20	12
7 Eas.	M.	20	2.31	131		192	112	102	2,250	10	53	3·6
			11.32	137		181	120	111	2,445	21	52	3·5
8 Lan.	M.	18	2.31	128	115-172	160	112	95	2,090	13	104	1·5
			11.32	,,		193	136	96	2,450	21	72	2·7
					Group 2.							
9 Gu. Sm.	M.	66	2.31	121*	99-149	190	95	72	1,960	3	26	5·6
			1.33	123		230	115	86	2,360	23	12	1·9
10 Fin.	M.	66	1.31	170	134-200	315	143	102	3,040	9	40	7·9
			11.32	151*		300	115			23	38	7·9
11 Sod.	M.	52	3.31	143	110-165	225	93	92	2,170	9	22	10·0
			11.32	152*		165	141	83	2,325	20	28	5·9
12 Str.	M.	52	1.31	156	97-146	179	134	97	2,370	19	48	3·7
			11.32	156		,,	,,	,,	,,	22	40	4·5
13 Sme.	F.	47	1.31	131	90-133	175	114	69	2,060	20	20	7·0
			11.32	126		,,	,,	,,	,,	22	22	8·0
14 Cla.	F.	46	2.31	124	111-164	207	126	102	2,440	10	28	7·4
			11.32	113		,,	,,	,,	,,	21	30	6·9
15 Haw.	F.	44	3.31	126	109-160	235	95	94	2,230	5	26	9·0
			3.33	120		220	60	82	2,000		30	7·1
16 Fors.	F.	28	3.31	133	97-143	142	124	83	2,070	13	46	3·0
			11.32	123		141	95	56	1,690	20	24	3·1
17 Jam.	M.	18	2.31	149	115-172	260	125	105	2,660	7	78	3·3
			11.32	153*		,,	,,	,,	,,	21	56	4·6
18 Ric.	M.	8	1.31	65½	58-88	135	136	68	2,110	39	26	5·2
			11.32	70		185	95	89	2,010	22	22	5·1

* Allowance made for clothes.

excluded from the following summary. Putting the 17 cases together in this further period of twenty to twenty-four months of higher carbohydrate feeding, twelve have remained stationary; in four the insulin requirement has markedly decreased, and in only one has there been an increase, probably due to increase in body weight. Comparing now in the eight cases of Group 1 the higher carbohydrate diets with the preceding low carbohydrate diets published previously, the change of diet has caused an increase in the insulin requirement in Cases III, IV and V; the change of diet has not made much difference in Cases I, II, VI and VIII, and in one of the

youngest patients (Case VII) there has been a decrease in the requirement from 64 to 52 units.

High carbohydrate—low fat diets have been used for 13 patients since the beginning of 1931 (Table II). The effect of these diets was first systematically investigated by Porges and Adlersberg [20] after bringing forward evidence that in normals carbohydrate stimulates the production of insulin; with this diet they found a diminution in the insulin requirement with patients treated in hospital, though the diet does not seem to have been used outside hospital. Rabinowitch [21] used this diet for diabetic patients who did not require insulin, and has more recently also used it for insulin patients. In the present series a ratio of carbohydrate to fat of 5 to 1 was generally aimed at; in practice the final ratio was usually a little lower, but it was not below 4 except in two cases. A 5 to 1 ratio was recommended by Rabinowitch, but in Porges

TABLE II.

Case	Sex	Age	Date	Naked Wt. lbs.	Range of predicted Wt. lbs.	Diet C.	Diet F.	Diet C./F	Diet P. (Cals.)	Period on diet months	Ins.	C./Ins.	Remarks.
1 Daw.	F.	74	6.31	164	104-153	220†	35 (6·3)		30	1,350	—	48	4·6	Heart failure
			1.32	149		less C.					7	16		Diabetes 5 months
			10.32	147		Avoids sugar					13	0		Heart "stronger"
2 Bar.	M.	66	6.32	126*	97-146	275†	65 (4·2)		50	1,935	—	46	6·0	B.P. 194/90.
			2.33			,,	,,		,,		8	30	9·2	Diabetes 14 mths.
3 Hol.	F.	65	1.31	118	92-136	213	109 (2·0)		63	2,140	21	38	5·6	B.P. 208/118 in
			2.33	105		290	60 (4·8)		67	2,085	5	32	9·1	9/32
4 San.	M.	35	1.31	140	110-165	110	149 (0·7)		79	2,160	15	64	1·7	
			2.33			260	65 (4·0)		80	2,000	8	62	4·2	
5 Woo.	F.	34	1.31	130	99-146	146	109 (1·3)		103	2,040	14	58	2·5	
			2.32	121		230	75 (3·1)		75	1,950	25	84	2·7	
6 Dow.	F.	27	10.31	123	99-146	68	183 (0·4)		85	2,380	30	36	1·7	
			8.32	123		230	50 (4·6)		75	1,720	10	18	12·8	
7 Den.	M.	18	9.31	134	112-169	80	165 (0·5)		142	2,440	144	80	1·0	
			10.32	139		220	55 (4·0)		127	1,935	13	78	2·8	
8 Mc.M.	F.	16	2.31	132	107-156	194	77 (2·5)		69	1,760	27	133	1·5	A little less food
			2.33	143	111-169	250	50 (5·0)		86·5	1,845	14	116	2·2	than stated
9 Al. Ba.	M.	14	12.31	77		200†	68 (2·9)		72	1,855	—	104	2·3	Diabetes, 4 years
			10.32	99	73-109	260	50 (5·2)		75	1,840	10	78	3·3	Coma
10 McCl.	F.	13	2.31	74	76-112	241	126 (1·9)		80	2,490	27	42	5·7	
			2.33	81		250	50 (5·0)		80	1,800	6	57	4·4	
11 M. Hal.	F.	7½	7.32	47	38-57	60	90 (0·7)		125	1,595	25	20‡	—	Diabetes and in-
			11.32	52½		150	30 (5·0)		75	1,200	3	34	4·4	sulin for 2½ years
12 R. K.	M.	7	1.31	56	52-79	196	88 (2·2)		75	1,925	26	35	5·6	
			2.33	66	63-93	270	75 (3·6)		83	2,140	14	44	6·1	
13 Gol.	F.	8	7.31	57	53-79	210	105 (2·0)		88	2,200	32	32	6·6	
			10.32	78	56-83	303	60 (5·0)		100	2,160	84	38	7·9	

Remarks.

* Allowance made for clothes. † Diet begun on this date. ‡ Insufficient insulin.

and Adlersberg's cases the ratio was often higher still. There were various reasons for choosing this particular type of diet. In Case I there was heart failure, and much glucose was ordered; this patient did particularly well. In Cases II and III the blood-pressure was high. In other cases it was hoped that some further improvement in tolerance might be obtained, and in the children Cases IX to XIII it was felt, in addition, that these diets were more physiological—at any rate they would be preferred—and this has proved to be the case. Sugar itself has been restricted to the meals which follow the insulin injections.

In six cases (including Case I already dealt with) the high carbohydrate—low fat diet followed immediately on a period of low carbohydrate feeding with or without insulin. The results have been gratifying. In Cases II and VI the insulin requirement has become much smaller than with the original diet. In Cases VII, IX and

XI the requirement, though high at the beginning of the diet has in the course of some months much diminished.

The change from a "higher" carbohydrate diet to a high carbohydrate—low fat diet is not so striking. There are seven cases—in Cases III, IV, VIII and XIII there has been little or no change in the insulin requirement. In Case V it has increased; in the children—Cases X and XII—there has been an increase; but the body weight has increased.

As regards the feelings of the patients themselves, stress need not be laid on the increased sense of well-being in those cases where the diet followed a low carbohydrate diet; this is only to be expected; and in Case IX in which there were epileptic fits, possibly originating from, but not definitely excited by, hypoglycæmia, these attacks have practically disappeared and luminal and bromide are now no longer required. The patients who have changed from a "higher" carbohydrate to a high carbohydrate—low fat diet have not in general noticed much difference in their feelings. San. (Case IV) observes that the new diet is more attractive, which is not surprising considering that he was previously only having 110 grm. carbohydrate. The children (Cases VII and VIII) are definitely more active on this new diet and the impression is gained that hypoglycæmic reactions are fewer.

Summarizing: It is suggested that in the case of children a carbohydrate to fat ratio of 4 or 5 to 1 is preferable to one of 2 to 1; but that as far as increase of carbohydrate tolerance is concerned, there is no evidence of any difference between the two diets in either children or adults. Either diet is much preferable to the low carbohydrate diets previously in use. This latter statement is also borne out by the observations of Graham, Clark and Robertson [22], who have gradually increased the carbohydrate content of the diet up to a maximum of 145 grm.

Conclusions.

(1) A re-examination of the published experiments in which heat, carbon dioxide and oxygen were simultaneously measured has shown that the generally adopted method of calculating the heat from the oxygen and carbon dioxide may cause serious error. The heat appears to be proportional to the carbon dioxide and under basal conditions there is a constant combustion ratio of carbohydrate and fat.

(2) Insulin increases combustion and also converts carbohydrate into some less oxygenated form.

(3) Further evidence is presented to show the value in diabetes of diets containing more carbohydrate and less fat than is usually given.

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Discussion.—Dr. H. P. HIMSWORTH said that after witnessing the effect of high carbohydrate—low fat diets on diabetes he returned to investigate the effect of fat and carbohydrate upon the sugar tolerance of normal people. He found in normal subjects, on a high carbohydrate diet, that glucose caused a small degree of hyperglycæmia, whilst on a high fat diet a high and prolonged elevation of the blood-sugar, often with glycosuria occurred. In addition it was observed that, after glucose, there was always a delay in the development of the arteriovenous sugar difference, and that this delay was decreased by feeding with carbohydrates and increased by feeding with fat.

The rate of fall of the blood-sugar after the injection of insulin was studied and it was found that the blood-sugar fell faster when carbohydrate had been fed that when the subject was on a fat diet.

It was concluded from these results, that although feeding with carbohydrate might produce an increased tolerance by sensitizing the insulin-secreting mechanism, the essential point was that this treatment caused an increase in efficiency of each unit of insulin. The hypothesis was put forward that insulin required activating by some unknown substance (insulin-kinase), that by feeding carbohydrates this substance was increased in the body, and that this was the cause of the increased tolerance for sugar shown on starchy diets and after administration of glucose.

[Various insulin-resistant cases were reviewed and it was pointed out that disease of the liver existed in practically all of them. From experimental evidence and these clinical observations it was suggested that insulin-kinase was produced in the liver.]

Dr. R. D. LAWRENCE said he thought that the theory of the increased stimulus to the pancreas by high carbohydrate diet was not adequate to explain the apparent increased tolerance with high carbohydrate diet. It should be remembered that high carbohydrate diet, in mild cases which did not require insulin and would still produce endogenous insulin, did not lead to this happy result. With very low Calorie diets these good results could often be obtained, but not otherwise.

The results of Dr. Himsworth's recent studies of the arteriovenous differences in blood-sugar were different from those which he, Dr. Lawrence, had obtained in 1925, when he had found an increasing arteriovenous difference established as soon as the blood-sugar rose after ingestion of carbohydrate. He thought such differences too slight and variable on which to base any theory of insulin action.

His experience of insulin-resistant cases had not revealed any clear evidence of disorder or failure of liver function. Furthermore, the cases (about half a dozen) of hæmochromatosis which he had seen and treated had never proved insulin-resistant.

Dr. P. J. CAMMIDGE said that the benefit of a low fat-content of the diet in diabetes was not a new discovery. In 1923 he had pointed out that one of the commonest causes of a seeming progressive failure of carbohydrate tolerance was a conscious or unconscious increase in the fat of the diet ("New Views on Diabetes," 1923, p. 467). He quoted cases showing how, even in pre-insulin days, a reduction of fat was often followed by a disappearance of a previous glycosuria and a drop in the blood-sugar, followed by a greater tolerance for carbohydrate. High carbohydrate diets, in the shape of Van Noorden's oatmeal cure and Mosso's potato cure, were likewise employed with advantage in some cases in pre-insulin days, but their sphere of usefulness was limited by the fact that they could only be used with safety in comparatively mild cases. Since the advent of insulin, however, it had become possible to give practically any desired amount of carbohydrate without running serious risks. Although it was possible that the administration of a diet rich in carbohydrate, covered by insulin, stimulated the production of insulin by the pancreas, he was inclined to think that a good deal of the improvement which might result from the treatment was dependent upon increased functional activity of the liver, and in this connection he was interested to hear what Dr. Himsworth had said, as it tended to confirm the view he had formed from clinical and experimental investigations. In his opinion too little attention had been paid in recent

years to the rôle of the liver in defects of carbohydrate metabolism. He believed that functional and organic changes in the liver played a much more important part in the production of diabetes in many cases than was usually allowed, and that inherited and acquired hepatic abnormalities were also responsible for the chronic hypoglycæmia associated with cyclical vomiting and other symptoms which tended to run in families. Incidentally he might mention that the first published case of this description was reported in this country (*Brit. Med. Journ.*, 1923 (ii), 320), and not in the United States as was commonly stated.

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VOL. XXVI., NO. 7 MAY, 1933

MAY 31 1933

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